ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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New Lamp and New Factory of the Mather Electric Company.

The new incandescent lamp and the new and very complete factory at Manchester, Conn., of the Mather Electric Company, are shown in this issue of the REVIEW. The claim is made by the company that these lamps are adapted to a higher potential than any others, and never blacken with use. The complete lamp is a graceful, well-constructed article. The company is now furnishing these lamps of 16 candle power, for potentials from 50 to 110 volts for use with any dynamos.

With its new factory facilities, and the aid of the expert knowledge of Prof. Wm. A. Anthony, under whose supervision the work will be done, the Mather Company has been enabled to commence the manufacture of instruments of precision under the most favorable circumstances, and in future will make this a prominent feature of their work.

The large factory, of which we present a view on page 3, is located in South Manchester, Conn., and will accommodate seven hundred men. The company has secured abundant land around the factory, and will enlarge as the growth of their business demands.

Settle's Electric Miners' Lamp.

Mr. Settle, the patentee of the water cartridge, by means of which dynamite is exploded harmlessly in fiery gas or in the heart of a barrel of gunpowder, is managing director of the Madeley Canal and Iron Company, in Stafford. His inventive skill has been applied successfully to the illumination by electricity of the mines under his control, so that the miners do not even require hand lamps in their operations. One of the seams of coal, 3 feet in thickness, is worked at a depth of 460 yards from the surface, and the wires are supplied with a current from an upper level 325 yards deep. Permanent lamps of 16 candle power are fixed throughout the workings at 60 feet distance apart. The small globe of glass which encloses the incandescent film is surrounded by a larger globe filled with water. The illuminant gas floats in this, and it is only when the globe is full of water that contact is established and light produced. As a matter of course, when the glass is broken contact ceases, and the water prevents any possibility of an explosion, complete extinction being instantaneous. These lamps are not affected by air currents. In some of the pits the electric light is used in every part of the workings. Mr. Settle is also the inventor of an electric hand lamp, in which the same principle of safety is carried out by means of another globe filled with carbonic acid gas. On breaking the outer globe the light instantly disappears.

The Electrical Review's New Office.

A front view of the new offices of the ELECTRICAL REVIEW is given on this page. The growth of the influence and business of this journal has been steady and decided ever since its birth, but in the last year its advancement has been very marked, demanding much more room and much better facilities for conducting the business. It is not wise to change often, and we have entered into a lease for ten years for the second floor of the handsomely-finished building at 13 Park row. There is no better location for down-town business in the city, and there are no more desirable publication offices in the city of New York. The REVIEW desires

FIG. 1.—NEW INCANDESCENT LAMP OF THE MATHER ELECTRIC COMPANY.

to acknowledge the many kind compliments and congratulations it has received over its successful move into new quarters. The members of its staff will always be pleased to receive calls from all workers in the great and progressive electrical field.

Licenses for Telegraphers.

A movement of importance to the traveling public is now on foot, writes a Washington correspondent. About a year ago the railroad telegraphers formed an organization of their own, and since that time the order has grown both East and West. At the coming session of Congress they intend to have passed a bill—and they claim to have congressional influence enough to do it—making it a penal offense for any railroad company to employ a telegraph operator who directs the movements of passenger trains who has not been granted a license. Licenses will be issued by the Government, the applicant being required to pass a practical examination, to produce evidence as to moral character and habits and to be of proper age. The leaders in this movement say that, as Congress has the power to regulate inter-State commerce, it has the power to issue these licenses, the same as it now says who shall command a vessel on navigable waters, or who shall hold a mate's or engineer's certificate. The operators claim that, despite the responsibility attaching to their occupation, mere boys and young girls without experience are put in responsible positions, and that this license system would correct that evil. Often, when accidents have occurred, they are blamed for them and made to suffer, when in reality the responsibility is not theirs, and under the license system in such a case they could appeal to the United States officials. It is not, they say, a combination to affect wages. If the scheme is successful, an effort will be made to have the licenses issued by the Inter State Commerce Commission. The Order of Railroad Telegraphers, as it is called, was organized at La Porte City, Iowa.

NEW OFFICES OF THE ELECTRICAL REVIEW—OPPOSITE ASTOR HOUSE.

The Lightning Record in Germany.

From a recent report by Dr. Hellman on statistics of lightning damage in Schleswig-Holstein, Baden and Hesse, it appears that the danger from lightning in these localities (unlike the case of other parts of Germany) has been decreasing of late years. Soft-roofed houses are fired about seven times oftener than those with hard roofs. Windmills are struck fifty-two times, and church and clock towers thirty-nine times oftener than ordinary houses with hard roofs. The marshy regions in Schleswig-Holstein are the most dangerous, and the land about inlets of the east coast the safest. With like conditions, the relative danger decreases the more houses are grouped together. In Baden the danger varies more than in any part of Germany (about Heidelberg it is 24, and in Waldshut 265 per million houses). In Hesse the low plain of the middle Rhine is the most dangerous part. In the fifteen years 1869-'83, there were killed by lightning for every million men in Prussia, 4.4; in Baden, 3.8; in France, 3.1; and in Sweden, 3.0. The geological nature of the ground, and especially its capacity for water, has an important influence. Thus, calling the danger on lime 1, that for sand is 9, while for loam it is 22. This is partly why most of South Germany and Austria is less dangerous than North Germany. There are four factors affecting the lightning danger to buildings: two physical—unequal frequency of storms and geological character; and two social—variable population and mode of building. Of all trees, oaks are most frequently damaged, beeches most rarely (in the ratio 54 to 1).

ELECTRIC LIGHT MEN AGAIN IN COUNCIL.

The Hub of the Universe Warmly Welcomes the Electrical Workers through Its Officials.

REVIEW OF THE FIRST TWO DAYS' PROCEEDINGS INDICATE A VERY SUCCESSFUL MEETING.

Electrical Motors and the Alternating Systems to the Front in most Interesting Style.

TUESDAY'S PROCEEDINGS.

BOSTON, MASS., Aug. 9, 1887.—From February to August is not a great period of time, yet it is very evident that electrical workers have put these few months to excellent use. The true electrical man is never idle. He is ever alert and watchful for new things, and no one knows better than he that progress is the order of the day among his fraternity. The attendance at this meeting—the midsummer convention of the National Electric Light Association—is already large and numbers are continually arriving. Although Boston is so far East as to make many of the western delegates feel disinclined to take the long, hot journey, the indications are now that all sections of the country will be well represented, and all sides of the various questions and problems relating to electric lighting and electric power most thoroughly discussed. The Boston press is present in numbers, and although at times the language of the electrician is slightly puzzling to the reporter, his Yankee ingenuity avails him much in compassing the discussion, and the reports so far give proof of much interest taken in the work of the Association by the daily newspapers of the city. The Boston electrical fraternity are present in full force, and are as hospitable and considerate as could be desired.

The officers of the Association are the following named gentlemen, all of whom were elected for the year ending February, 1888:

PRESIDENT.—J. F. Morrison, Baltimore.

VICE-PRESIDENTS.—Edwin R. Weeks, Kansas City; A. J. DeCamp, Philadelphia.

SECRETARY.—T. McCoubray, Baltimore.

TREASURER.—Chas. Cooper, Brooklyn.

EXECUTIVE COMMITTEE.—Fred A. Gilbert, Boston, Chairman; George S Bowen, Elgin, Ill.; Frank Ridlon, Boston; J. F. Noonan, Paterson, N. J.; Dr Otto A. Moses, New York; Eugene T. Lynch, Jr., New York; Stephen Holbrooke, Philadelphia.

The Executive Committee and officers met Friday last in Boston, and arranged the programme and completed all details relating to the convention.

THE FIRST SESSION.

The handsome double parlors on the first floor of the of the Parker House were occupied by a large number of vigorous looking men, when the convention was called to order on Tuesday.

(*Continued on page 9.*)

Practical Notes Concerning the Construction, Use and Management of Storage Batteries.

By A. Reckenzaun.

Durability of Storage Batteries.—When speaking of the durability of batteries, we have to consider separately the age of positive plates, the age of negative plates and the age of the boxes or receptacles As regards the latter, we have to take into consideration the kind and quality of the material of which the boxes are made. If these are of toughened glass which is never exposed to extremes of temperature, and if the same are not roughly handled or knocked then we may assume that such receptacles are everlasting. For stationary purposes glass cells are generally used. In other cases, however, where the batteries have to be moved frequently, or when the same are utilized for locomotive purposes, then glass is not a reliable material, and wood or hard rubber is substituted. Wooden boxes are easily attacked and destroyed by the acid; therefore it is customary to line them internally with pure sheet-lead, carefully burned at the joints. Such boxes are generally made of teak, or other hard wood which is not liable to warping. When boiled in paraffine wax and pitched inside before the lead lining is fixed, wooden cells will last a long time—several years—if kept dry and clean externally. Sometimes hard rubber or ebonite boxes are used; but these are more expensive and less strong than wooden ones. Boxes have also been made of an alloy of lead, of tolerable stiffness, and many other materials have been tried with more or less success. In any case, the durability of such receptacles will be found of minor consequence if compared with the durability of the electrodes. The age of plates is the point of vital interest. When we are asked what the life of a storage battery may be, we at once think of the plates, and almost ignore everything else; and we feel mostly concerned about the positive plates. We have already explained some of the causes which destroy the positive plates, and we have shown that the treatment of secondary batteries has as much to do with their durability as methods of construction or quality of materials. Thick plates, for instance, are found to last longer than thin ones. This is only natural, when it is remembered that corrosion takes place upon the metallic support, which wears out in time. This corrosion proceeds mainly from the surface inwards, and the internal parts of a thick plate are protected to a great extent by the mass of superincumbent material. Thick plates offer an advantage, if, firstly, the cost of material is much less than the cost of manufacture; and, secondly, if weight and space are of little consequence. The cost of material may, however, exceed the cost of labor, and the value of the worn-out material may have a market value not much less than the original metal. Under these circumstances it might happen that it is cheaper to renew the plates frequently rather than increase their volume. Weight and space are of the utmost importance in secondary batteries used for electric cars and boats, and in such cases we make the plates as light as compatible with strength of structure, almost irrespective of the cost of labor and the price of lead. Here we have to take into account the energy continually wasted in propelling the battery along with the vehicle it propels, and the point of economy is reached when the depreciation of the battery equals the cost of the motive power which is spent in this auto-propulsion. By decreasing the weight of material we reduce the activity of the plates, or the *rate* at which the current is consumed, and the life of the plates is to a great extent proportional to the amount of work done. In every instance we reach a certain limit which has to be considered with reference to any particular application. If the frequency with which plates have to be renewed is such as to cause little inconvenience, then one stage of the durability difficulty has been overcome. Frequent renewals do not cause a deal of inconvenience when systematically carried out, as would be the case with tramways, but in electric light installations much annoyance is likely to result through such a process, therefore it is advisable on several grounds to produce durable and strong plates for stationary purposes.

Durability versus Waste of Energy.—Let us make a rough calculation to show the relative losses which occur in the case of tramcars propelled by means of storage batteries, leaving out the question of small volume, which is merely a matter of convenience. We assume that the tractive force on a level tram line is 26 lbs. per ton when the car is in motion, and that it takes 100 lbs. per ton to set it in motion; furthermore that there are easy gradients and curves which demand a tractive force of, say, 60 lbs. per ton; we may get an average of about 52 lbs. per ton throughout an ordinary track when running at the rate of seven miles an hour. The saving of one ton weight in the shape of secondary batteries would under the above conditions represent a saving of $\frac{52 \times 7 \times 52}{60 \times 33000} = .97$ horse-power applied at the driving wheels. If we allow efficiencies of 80 per cent. in the gearing, 80 per cent. in the motor, 75 per cent. in the accumulator and 90 per cent. in the generating dynamo, then we have a total efficiency of about 33 per cent. between the driving wheels and the steam engine; therefore in order to produce the above tractive force upon the tram rails we require $\frac{.97}{.33} = 2.94$, or, say, 3 horse power from the prime mover.

The value of a horse power hour varies considerably, according to the price of coal, of labor, and especially with the size of the engine. But we may take the cost of a steam horse power at £12 per annum in large engines, inclusive of all charges; consequently 3 horse power for, say, 15 hours a day, will be worth £36 sterling a year. For this amount of money we can purchase three tons of new lead at the present prices, or we may employ this sum in paying wages for labor. Fourpence per plate, for instance, paid for casting, pasting and fixing may be a fair remuneration; and the amount stated above (£36) would at this rate suffice for the conversion of 2,160 old positive plates into new ones. By saving weight we save power; and the point of economy is reached, as we have hinted before, when the energy wasted in propelling the accumulator of a car equals the cost of replacing worn-out plates. We cannot recover the entire quantity of lead originally put into a plate, although the weight of a worn-out plate is practically the same as that of a new one. There is necessarily some loss in the reconversion of peroxide and sulphate into metallic lead, which may be valued at between 30 and 40 per cent. in money, inclusive of labor and fuel used in the furnaces.

All the above figures are approximate only. The exact values can only be ascertained when all the factors are known; and among the principal factors are, firstly, the size and total weight of a car; secondly, the nature of the road and the speed to be applied; thirdly, the number of cars supplied by one charging station, and, lastly, the cost of fuel, labor and all necessary materials.—*London Electrical Review.*

A Powerful Battery.

The largest secondary battery yet constructed is probably that in the basement of the City Hall of Paris. It includes 165 gigantic elements, 10 inches in diameter and 31 inches in height, and it yields a power of 100 horses. It weighs 11 tons, and contains 975 gallons of liquid. Its purpose is to regulate the 2,200 Edison lamps that light the Hall of Fetes and the adjacent salons, the contract requiring that the battery shall keep up the light from twenty to thirty minutes in case of accidental stoppage of the machines. The current producing machines for this part of the illumination alone are three large Gramme dynamos and four steam engines, of a total power of 120 horses.

Central Electric Lighting Station at Vienna.

Our esteemed contemporary, *Industries*, recently published a brief outline of the history of this undertaking, and a double-page supplement showing the plan of the boiler house and dynamo room. The boilers used at the station are of the kind known as Captain Scott's patent. The water leg below each boiler is placed between the two furnaces. The products of combustion pass along this water leg and beneath the shell to the back tube plate, returning through the tubes to the front end, and into an iron smoke box common to a pair of boilers. From these smoke boxes the gases are led through downtakes placed midway between each pair of boilers to a system of underground flues indicated in the illustration by dotted lines, and into the base of the chimney. The exhaust steam is also taken into the chimney, but as it would cool the products of combustion and impair the draught if this steam were discharged at the bottom, the exhaust pipe is carried centrally right up the chimney almost to the top, so as to afford an outlet for the exhaust just below the ornamental spark catcher. The chimney is a cylindrical shaft 150 feet high, and 8 feet 6 inches internal diameter. Each of the six boilers is capable of evaporating 400 gallons of water per hour when the furnaces are fired with small refuse coke from the gas works, which will probably be the fuel usually employed. Reckoning 30 pounds of water per indicated horse power it will thus be seen that the present battery of six boilers is capable of developing 800 horse power. The boilers are fed by water from a well sunk on the premises. The water is pumped into tanks, and provision has been made to purify it by forcing it through Clark's combined feed water heaters and filters, two of which are already installed, whilst room is provided for two more. The pipe connections are arranged in such a manner that the exhaust steam may be sent either through these feed water heaters and then to the chimney or direct to the latter For the present it is not intended to apply the filters until experience has shown whether the boilers cannot be kept sufficiently clean by periodically blowing off from the water leg. The feed water is forced into the boilers by a pair of Worthington high pressure pumps, such as are ordinarily used for working hydraulic accumulators. This type has been chosen in preference to the ordinary feed pumps on account of the high pressure which will be carried in the boilers. These boilers have been tested to 15 atmospheres cold water pressure.

A remarkable feature in this installation is that the steam and water connections are in duplicate, this precaution having been taken in order to remove all possibility of a stoppage in the supply of electricity consequent upon the accidental bursting of a pipe. The steam reservoir on each boiler is provided with two stop valves, and two steam pipes, branching out in opposite directions, and joining the main steam pipes. Each set of pipes is large enough to supply the whole of the steam required, and should a pipe burst in one system it is only necessary to close all the stop valves on this [illegible] open those of the other system. The boiler house being at a sufficiently low level, it was possible to arrange all the steam pipes with a sufficient incline, so that the condensed water should by gravity drain back into the boilers. The engine and dynamo room is situated to the left of the main entrance, and is 78 feet long, 29 feet wide, and 18 feet 4 inches high. For the convenience of erection and repair of the machinery it has been fitted with an overhead traveler running from end to end. Provision has been made for twelve combined sets of main engines and dynamos, and a corresponding number of exciting machines. The dynamos are of the vertical Crompton type with double horseshoe magnets, and they are driven direct by Willan's compound central valve engines. Five of these sets have already been fixed, and the rest will be installed as the demand for current increases. They are of the most modern type, the peculiar feature being the central valve worked from an eccentric on the crank-pin, by which a very quick cut-off is obtained. The engines are single-acting compound, with the high pressure cylinder above the low pressure. At the lower end of the piston rod is a conical air piston, and at each upstroke a certain quantity of air is compressed, by which means the moving parts are brought to rest without entirely removing the pressure between the connecting rod and crank-pin. If it were not for this air buffer the momentum of the moving parts would, as soon as a certain speed is exceeded, tend at a certain point of the upstroke to drag the end of the connecting rod upwards at a faster rate than corresponds to the uniform rotation of the crank-pin, and the surface pressure between the pin and the connecting rod brasses would change from the upper to the lower side. The result of this would be a tendency to knock unless the brasses were a perfect fit. But by the introduction of the air cushion an additional downward pressure is secured on the crank-pin, so that knocking is practically impossible. The waste of power entailed in the use of the air cushion is small, since the greater part of the energy expended in compressing the air on the upstroke is again returned on the downstroke, the only loss being leakage of air past the piston, and that portion of the heat of compression which flows through the metal of the air cylinder. With high speeds, the time during which the flow of heat can take place is, however, so short that the loss from this cause is not of great importance.

Each dynamo is designed to give an output of 72 kilowatts, or 120 amperes at 600 volts pressure. The armatures are 36 inches long, and are supported in a bearing at the commutator end whilst the other end of the dynamo spindle is bolted solid to the crank shaft of the engine by a steel coupling. The end bearing of the engine shaft has therefore to support a portion of the weight of the armature. The field magnets are divided at the center line of the armature, so that the top half can be lifted off by the traveler. This facilitates examination of the armature without removing it from the machine, and should it become necessary to remove it for further examination or repair this can be done by simply lifting it out by means of the traveler. In most dynamos it is necessary to insert the armature horizontally—an operation which always entails some risks of chafing the wires against the surfaces and edges of the pole pieces; but by dividing the magnetic field horizontally, the danger of accidental damage to the armature upon removal or insertion is obviated. The engines are provided with centrifugal governors, and with Willans' electric governors wound for constant current The field magnets are separately excited, two small sets of combined engines and dynamos being provided for this purpose. In order to avoid the risk of a discontinuance of supply in case of a breakdown of any one of the exciting machines, accumulators have been installed and connected in parallel with the exciting dynamos. These accumulators are in themselves sufficient to supply the exciting current required by the dynamos for several hours, thus giving ample time to effect some small repairs, or to set a spare exciting machine to work in case of a breakdown. The current from the [illegible] dynamos is conveyed to a main switch[illegible] of the plug type, which is so arranged [illegible] any one of the machines can be coupled to any one of the five main circuits which will eventually branch out from the station At present only two main circuits have been laid, but three more are in hand.

The mains consist of lead-covered Berthoud-Borel cables laid underground. Those already installed are carried round the ring as far as the opera house, where they enter the battery room. The whole of the accumulators are charged in series, but feed the lamps in several parallels, for which purpose five cables are taken from the batteries to a set of distributing switchboards, consisting of angle iron frames and slate bases. In the lower part of these boards are fixed five copper bars, each 1 inch in area and from them insulated rods are carried at right angles across the board to the various circuits. The usual regulating switches are provided for adding more cells as the batteries become exhausted, and the connections are so made that any of the batteries can be used to supply current to any of the lamp circuits. All the switches are of a specially massive design, suitable for the large current they have to carry. The whole of the installation, with the exception of the mains, has been in an advanced stage for some months past; and now that the vexatious opposition of the Town Council to the laying of mains has been overcome, regular working will probably begin at an early date.

the Measurement of Electricity for Central Stations.

The London *Electrical Review* says that the difficulties of all kinds which oppose the arrangement and the working of small installations for the electric light in large cities necessitate the establishment of large central stations for generating the current, and of conductors for its distribution, analogous to the pipes which convey gas and water to houses. It is only by means of such central establishments from which any one can obtain, without difficulty, for payment, the electric current required for light, for the production of power, or for other purposes, that electricity can furnish the great services it is destined to produce. Such central stations, writes Dr. Werner Siemens, in *Elektrotechnische Zeitschrift*, equipped with the needful reserves, and with technical arrangements for safety of all kinds, confer upon electric lighting, and the transfer of power, that safety and trustworthiness which are required to earn the full confidence of the consuming public. Furthermore, large motors and electric appliances work far more economically than small ones. Hence the cost of producing the electricity supplied to consumers is essentially smaller from well arranged central stations than from small separate installations, notwithstanding the loss of power by the resistance of the system of conduction.

One of the greatest merits of Edison as regards the development of electric lighting is, that he was not merely beyond doubt the first to bring the glow lamp into a useful form, but that he was the first to plan, and to carry out in practice, electric central stations. For this purpose there is required the construction of a measuring instrument which registers permanently the quantity of electric energy taken by each consumer. Edison has devised several such instruments, some of which fulfill their purpose in a fairly satisfactory manner. After him a number of inventors have busied themselves with the problem, and we have now quite a series of electric registration instruments for central stations. They may be divided into two groups—measurers of energy and measurers of currents. The theoretical question is answered only by the first group, since only the sum of the electric energy used by the consumer, *i. e.*, of the products of the electric tension e, the strength of the current i, and the time t, during which the consumption takes place, corresponds to the real value of the electricity furnished. At central stations it is a necessary condition for the electric tension of the current produced to remain always constant. It is the task of the technical electrician to combine the conductive system in such a manner that the current conveyed to the consumer may have always as far as possible the same approximate tension. The tension e must therefore be assumed as a constant factor for the installation in question. It is sufficient to arrange the instruments so that they may continuously measure and add up the products, i, t.

The simplest method of measuring and adding these products is certainly the electrolytic, as proposed and successfully executed by Edison. As the precipitation of a metal is proportional to the quantity of electricity which passes over between the electrodes, that is, to the sum of the products, i, t, it is sufficient to weigh the anode or the cathode of an electrolytic cell in order to determine by the difference of weight the quantity of electricity used in the time between two weighings.

This measurer of electricity, the simplest conceivable, acts with full certainty and sufficient accuracy if it is made of so large dimensions that it can be traversed by the entire maximum current to be measured. But as this would require inconveniently large measurements of the cell, it is generally thought sufficient to pass a part of the current through the apparatus. But herewith the method loses its accuracy, as one part of the current passes through a metallic conductor, and the other through an electrolytic liquid. But the resistance of the electrolyte is modified by changes of temperature in a reverse manner to that of the metal. In addition, the decrease of the specific resistance of the electrolyte takes place, in a very rapid progression, with the increase of temperature. This dependence of the indications of electrolytic measurement on the temperature of the cell renders its application scarcely permissible, unless the entire current can be passed through the apparatus.

Another method of measurement has been proposed by Edison. The current, or a branch of it, is passed through the coils of a small electro-magnetic machine, which has to perform work proportional to its speed of rotation. If this performance of work is so great that the rotatory speed of the machine is very considerably lessened, so that the internal friction of the machine may be considered as vanishingly small, in comparison with the external work performed, the speed of rotation, within certain limits, gives a measurement of the strength of the current, and the number of rotations, as shown by a counter, furnishes a measurement of the quantity of electricity which has traversed the conduction. Besides Edison, several other constructors have proposed electricity-meters on this system for stations supplying currents None of them, however, has hitherto given quite satisfactory results. This is chiefly because the resistance which liquids oppose to the measurement of solid bodies does not increase directly with the resistance, but in a higher proportion.

I pass over many constructions of electricity and energy-meters which are theoretically correct, but too complicated or delicate for practical use. I will mention here merely two appliances which have been found capable of employment, within certain limits. These are the electricity-meters of Ferranti and of Aron.

Ferranti's instrument depends on the fact that mercury, which surrounds a magnetic pole, rotates around it if traversed by radial currents. Ferranti measures the speed of rotation of the mercury by means of a light lever dipping into the mercury and placed concentrically with its rotation. Its revolutions are registered by wheel-work. This apparatus gives satisfactory results if it is well regulated, and if the resistance of the revolving lever and of the registering wheel-work is vanishingly small. But it is to be feared that this system will not hold good in permanent practical work, considering the extremely feeble unipolar rotatory force and the excessive fineness of all the movable parts thus necessitated, as well as the changes which the mobility of the mercury undergoes on prolonged contact with solid metals and with the air.

The electric meter constructed by our colleague, Dr. Aron, seems to give quite satisfactory results. As it will be known from his memoir, it depends on the fact that the time of oscillation of a pendulum decreases with the square roots of the attractive forces acting upon it. If the attraction is slightly increased, we may, without any perceptible error, assume the decrease of the time of oscillation as proportional to such increase. Dr. Aron uses as the weight of the pendulum a steel magnet, and causes the entire current to be measured to pass through a coil of wire which is set up vertically beneath the pendulum. If the pendulum is connected with accurate clock-work, the difference of time between this clock and a normal clock, furnishes a measure of the quantity of electricity which has traversed the coil of wire. Dr. Aron has recently sought to obviate the defect that the consumer himself cannot at any time observe, and check his consumption of current by using two clocks for every electricity-meter, so connected with each other by a differential mechanism that a counter continually indicates the difference of the movement of the accelerated clock and the normal clock.

As a weak side of this well-executed system of continuous current measurement, it must be mentioned that the limits of the strength of current, which can be registered by the apparatus without error, lie rather close together. This is especially disturbing, when, as is frequently the case, the consumption of electricity fluctuates between wide limits.

The electricity meter here displayed is a further development of the system of an electromagnetic machine with a performance of work proportional to its speed of rotation. The performance of work is electro dynamical, and is, within wide limits, exactly proportional to the rotatory speed of the machine.

The apparatus consists essentially of a small Paccinotti ring with a vertical axle, upon which is fixed a commutator of very small diameter formed of platinum wires. The ring is surrounded with a copper cylinder, with which it is firmly united concentrically. A horseshoe magnet of tungsten steel as hard as glass, projects with its pole ends into the copper cylinder, so that they stand almost opposite the ring, without, however, touching either the ring or the copper cylinder. This copper cylinder, which rotates with the ring, is in turn surrounded by a fixed iron ring. If a current traverses the coils of the ring, the copper cylinder revolves with it between the polar ends of the steel magnet and the iron cylinder which encloses it, whereby there are induced in it currents of great strength proportional to the speed of rotation. These currents reduce the speed of rotation to about $\frac{1}{20}$th of the amount which they would have without this electro-dynamical reduction.

As the weight of the revolving part of the apparatus rests upon a point, and is much lessened by the attraction between the poles of the magnet and the iron ring, and as the commutator has a very small diameter, and is touched very lightly by the conducting wires, the ring is thrown, even by very feeble currents, into a regular slow rotation, which is completely proportional to the strength of the current within wide limits.

A simple counter, whose dial plate is always visible through the glass lid of the cylindrical screen of the apparatus, shows accurately at all times the quantity of electricity consumed. The arrangement of the proper speed of rotation for registering the current can be effected easily by means of a small by-contact in the interior of the closed apparatus, or by turning the steel magnet, whereby no visible sparks are produced at the commutator. The circumstance that the same steel magnet which occasions the rotation of the ring exactly proportional to the strength of the current, effects also the electro-dynamical damping, makes the rotation fairly independent of changes in the strength of the permanent magnetism. If, therefore, on prolonged use the magnet really becomes weaker, this will have no particular influence on the measurement of the current. The speed of the rotation of the apparatus can increase from 7 to 250 revolutions per minute without injurious heating of the coils and the copper cylinder, and without affecting the proportionality to the strength of the current. With a proper division of the current, the apparatus is applicable for an installation of 30 to 40 glow lamps, even if the consumption of a single lamp is to be registered. If a greater range of measuring power is required, it can be effected by a combination of two equal meters. If the division of the current is so arranged that the branch resistance of the main current in the second apparatus is only one-tenth as great as that of the first apparatus, the second is traversed only by one-tenth of the current which passes through the first, and the indications of its counter have therefore a tenfold value. By a simple self-acting commutator we may introduce into the second apparatus only one-tenth of the branch resistance of the main current instead of the whole, if the strength of the current exceeds a certain limit. Thus the extent of the power of measurement is increased tenfold without displacing the lower limit. Of course, the indications of both meters must be added together to give the consumption of electricity.

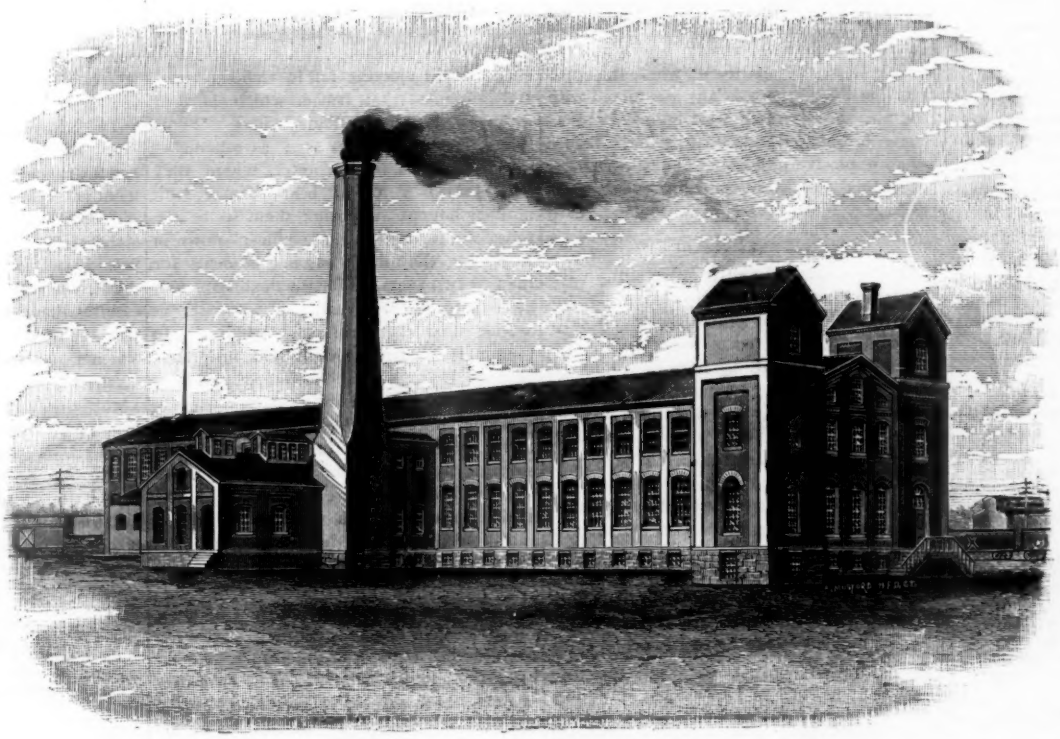

Fig. 2.—The New Factory in Manchester, Conn., of the Mather Electric Co.

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NEW YORK, AUGUST 13, 1887.

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The speech of welcome by Mayor O'Brien to the members of the Electric Light Convention, in response to President Morrison, captured the delegates, and the cordial manner all were received by Presidents Gilbert and Coffin, and Messrs. Garfield Ridlon, Swift, Slattery, Garratt and others, made each and all feel happy.

The officers of the Thomson-Houston Electric Light Company extended an invitation to the members of the convention to visit their extensive works, which was accepted, and they were subsequently entertained in a royal manner by this company at a banquet tendered under the auspices of the Boston Electric Club a full account of which will be found in another column.

To electric light delegates and visitors: Do not fail to record your name and business in the REVIEW's register.

A complete stenographic report of the proceedings of the National Electric Light Association will appear in our next issue. These reports are recognized as being the most reliable and complete published.

The ELECTRICAL REVIEW headquarters, at the Electric Light Convention this week in Boston, are Parlors 5 and 6, Parker House, directly opposite the Assembly Rooms of the Association. You are all invited to call.

The REVIEW staff desire to make their best bow to Mr. Eugene Phillips, president of the American Electrical Works, for kind invitations to his historic and ever-popular clambake, which will be held on Friday, August 12, at Vue de l'Eau Club, near Providence, R. I. This is his ninth clambake. The reception committee is Messrs. Frank Ridlon, John I. Sabin, H. W. Pope, E. D. Baker, A. C. White, and W. H. Sawyer. We trust that a chair or two will be reserved for us.

An electrical apparatus, invented by M. Arnould for the indication and escape of gas, is now coming into use in Paris. It consists of a copper cylinder containing a bichromate cell, the current being passed through a small platinum wire, raising it to a dull red heat. If in the apartment where the apparatus is fixed, there is any gas mixed with the air, the platinum wire immediately becomes brighter, thus indicating the presence of an explosive mixture. The apparatus is exceedingly sensitive, showing even a small leakage. Thus does electricity stand guard over gas.

There seems to be an opening still for the gentleman who desired to invest in the electrical field, and whose letter we published and commented on week before last. Several communications have been received at this office (and duly forwarded) in which the writers proceed to state that they have the very thing to make the investor happy with a fortune in a few months, if he will only furnish the means to exploit the invention. Electric motors, electric fire alarm systems, two new telephones, four electric light systems, etc., are among the inventions sent in. We trust they will prove all that the industrious inventors hope, and that they, with our correspondent, will secure fame and riches. If letters continue to come, we must conclude that the REVIEW is carefully read by a large number of wide-awake inventors, as well as by the leading investors in electrical apparatus.

THE BOSTON CONVENTION.

Another half-year of electrical work and progress has passed away, and this week electric light men are comparing notes in Boston. At the time of writing (Tuesday, August 9th) everything seems propitious for a large, interesting and successful meeting. There are a number of committees to report, including "Wire Gauges," of which Mr. A. V. Garratt is chairman; "Insulation," of which Prof. Houston is chairman; "Patent Legislation," of which Mr. Arthur Steuart is chairman; and "Distribution of Electrical Energy by Means of Secondary Generators," of which Mr Weissleder is chairman. These reports are promised to be quite comprehensive, and will, no doubt, be discussed intelligently, and at length. Carbons will also receive attention, and the question of organizing a mutual carbon company, owned exclusively by consumers, will, in all probability, be presented. The earnestness of all present, the evidence in conversation of the existence of many well-informed minds, and the cheerful view with which all seem inclined to regard the future of electricity, are features of this gathering that promise well for its future, and for the great influence it will continue to bear on all electrical progress. The Association is doing its work well; and may it ever continue so to do, is the earnest wish of the REVIEW.

OUR CHICAGO LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The excitement in electrical circles for the past few days has been the opening of the bids for the city's electrical light plant. These were handed to the Commissioner of Public Works, and the date of the opening, the 30th of July, was changed to the following Tuesday, August 2.

Pretty much every electric light arc system was represented on the occasion, and these in some instances were known to be pulling in double harness with a wire man for a mate. The belt men and the engine men too had an interest in the matter, and were not too far away to be found when it might be time to go over to Hannah & Hogg's or Lansing & Sickler's in case anything should happen to require a little assistance from these parties. Such assistance is sometimes needed, you know, when a contract is awarded.

The following are the bids: Excelsior Electric Company, $34,745. Brush Electric Light Company, $36,347. United States Electric Light Company, $34,565. Chicago Arc Light and Power Company, $35,000. Ball Electric Light Company, $31,700 to $38,040. Fort Wayne-Jenney Electric Light Company, $29,500. Western Electric Company, $29,295.

Then up jumps somebody and remarks that down in Rochester, where Sam Patch once jumped over the fall in Genesee river, and originated that truism which is dear to every born inhabitant there—"Some things can be done as well as others!"—says that down in Rochester, where they once buried a lot of bears' bones with military honors, supposing them to be the relics of a certain patriotic officer—down in Rochester, they don't pay but 30 cents for the first two years, 28 for the next two, and 27 cents for the fifth year.

And then the Professor Admiral—late Commodore Barrett, pricks that little suggestion of municipal boodleism, with a needle-pointed fact or two, as thus:

Rochester's council has authority delegated by its charter to enter into such a contract covering five years. Chicago can only make a contract of this nature for one year. And again, Rochester has a water power which is utilized for running these lights, or a portion of them, and the coal pile is what makes electric lights expensive.

Now, to ask anyone to put up a plant of the dimensions demanded, run it a year on uncertainties as regards the future, and do all this at a rate which is paid on a five-year contract with water power to run the dynamo, rather takes the starch out of the statement that 45 cents is extremely high, doesn't it?

All things considered, the figure is probably as low as any one can reasonably do the work.

Professor Barrett's idea of undergrounding this plant is both original and unique. He purposes utilizing the river proper as a conduit, the wire in the form of armored cable to be suspended in the river, below frost line, along the docking. This arrangement will permit of ready removal in case of necessity, and it effectually defies the best laid scheme of pick, and spade, and rats.

Where the cables emerge from the water they will be carried high enough to be safe from moisture and properly protected. The insulation resistance of the cable must be 500 megohms to the mile. And one electric light individual who has been a good customer for and user of "Undertaker's" wire, remarked after an introductory whistle: "How is that for high?"

It has been said of officials in the navy that few die and none resign. In the inland navy hereaway, this has been altered to some extent. The telephone river dispatcher system was rather too much for the first appointee, and a second has been ordered up from the lower grade, and taken command. Everyone says the service is improving, and the burr edges are gradually wearing smooth.

Mr. A. J. Whitman has left the electrical field in disgrace. He held a position with the Central Union Telephone Company, in the Chicago office, as bookkeeper, until about a week ago, when the fact developed that Mr. Whitman was a sort of a "Jim the Penman," as it were.

Whitman, or Wittman, had a Spanish *alias*, Joseph Espenola, by which name he was known among sports. Gambling was his bane, and the cause of his ruin. He first stole a check, which he carried some time, until he finally got his courage up to the sticking point and gambled it away. The first step taken, success crowning the industry, he went into business more extensively. He stole blank checks, made these payable to the order of some officer of the company, forged Manager Phillips' and Secretary Chapman's signatures, and then did the same with the endorsers.

The crime was confessed, and the criminal promises to do everything in his power to render justice to his former employers. Up to the 6th instant the defalcation amounted to about $8,000, and it is thought this will nearly or quite cover the defalcation. As usual, the scheme by which the doctoring of the books was done was infallible, and, as usual also, was thoroughly unearthed with trifling effort in the hands of an expert bookkeeper.

The Western Electric Company is about to overhaul, re-wire and new-construct the Grand Pacific Hotel electric light plant, which is one of the veterans of the city and the West.

The Edison people are very quietly working, putting in their underground system, and the majority of the citizens haven't found it out yet. Oh! if they should!

"Boy," said the Western bull-whacker, "that baby pistol will get you into trouble yet. If you shoot it at anybody and he finds it out, you may git a darned good lickin'."

After something of a struggle between rival companies, the Chicago Haymarket Theater contract for electric lighting has been awarded to the United States Electric Lighting Company. The building is in process of construction, but the proprietors felt that this matter might better be settled early. Up to the present time they have been in the fix of the captain whose two best girls visit him in prison, when he sings:

"How happy could I be with either
Were 'tother dear charmer away."

CHICAGO, Aug. 8th, 1887.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

There seems to be no doubt of the consolidation of all the horse railroads running into Boston as a part of the West End Railway Company. The combined road will be the largest horse railroad in the world. There is some question regarding the name of the road. "Consolidated" is in use by the combined Middlesex and Highland roads, which will make a part of the new company; and the terms of the act granting the right to consolidate decrees that the whole shall be called the West End Railway Company. It has been suggested that on account of the maze of lines and connecting links of this new corporation, that the name Octopus be given it. The West End Railway Company, though from its incorporation four months ago it has not laid a single rail, has investigated the subject of electric motors for street cars, and the uniting of the entire street railway service of Boston under one head will give rise to an electrical railroad of considerable size. If the Lynn and Boston Railroad is included in the consolidation, in the course of a year or more one may ride from Jamaica Plain to Marblehead, a distance of 17 miles, in a car driven by an electric motor.

J. G. Low, of the Low Art Tile Works, Boston, has his carriage fitted with incandescent lamps, lighted by storage cells. The lamps, five candle power, are in the lamp boxes in the same position as that of a candle formerly used. The cells, three in

series, made by the Electrical Accumulator Company, of New York, are in a tightly closed box, to be permanently placed under the carriage. By a switch the lights are turned on or off at the pleasure of the driver. One charge of the battery lasts from one to four weeks, according to the length of time it is in use. The absurdity in the use of candles for carriage lights is apparent when the electric light carriage is in sight, and the general adoption of this new method of lighting will, in the better class of carriages, be only a question of time.

An electrical engineer was testing the lightning rods on the buildings in Harvard University, and was asked what was their condition. "Quite a number are broken and are being repaired. Some are useless for the want of good ground connections. I attach to the water pipe as a permanent ground for measurement, and through my instruments to the rod I am examining. I use a telephone in place of a galvanometer. Reversing the connection of my battery, a second reading is taken in order to eliminate the error due to couple formed by the brass water pipe and the iron lightning rod. The highest ground resistance I have found is 700 ohms, the lowest four ohms, that is one on Gray's Hall. No, I don't think it is practicable to make a ground of less resistance than that. Much higher ones are met with in telegraph lines, 20 or 30 ohms being common."

BOSTON, Mass., August 12, 1887.

Compressed Air for Electric Lighting.

To avoid the difficulties and the inconvenience attending the use of steam engines, a strong company has been formed in Paris, *Industries* states, for the supply of compressed air to users of dynamo machines for electric lighting. A central station has been provided, where engines of 3,000 aggregate horse power will compress the air for this purpose. The mains are already being laid, and the work is being pushed on with all possible speed to furnish motive power to the theaters, within the time allowed by the Government order, for the substitution of electric light for gas. With electric lamps and compressed air engines, the maximum of safety from fire will be attained. The offices of the *Figaro* are to be the first to be lighted by this means The scheme is to be extended to the provinces, and Lille will probably be the first town to adopt it.

* * An electric yacht was recently launched at London. The boat is 90 feet long, 11 feet 6 inches beam and 5 feet 6 inches deep, and will draw 3 feet of water. The motive power will be supplied by Elieson storage cells, and the screw will be driven by an Elieson motor, of the pattern which has already been employed with some success for street car traction on the North London tramways.

Convention News.

The large parlors of the REVIEW headquarters are beautifully lighted by the Sun alternating system. The colored globes and large incandescent lamps attract much attention.

The Edgerton motor people of Philadelphia are here with a good exhibit. Messrs. Sharps, Buchanan, Edgerton and Hall being in attendance.

A daily, with an interesting account of the proceedings, is issued by *Modern Light and Heat*, of Boston, with very commendable enterprise; the first issue contained excellent likenesses of the officers of the Association.

In the Baxter Motor exhibit, which occupies three large parlors on the first floor, some twenty young ladies are employed, using the motors for various kinds of sewing. It goes without saying that these parlors are well patronized. The light for these parlors is furnished by the Sawyer-Man Company, the dynamo being run by a Baxter motor.

In three rooms on the second floor the Thomson-Houston Company has a most interesting exhibit of their new motor, ¼ horse power and 5 horse power, and of their alternating system. This exhibit we shall describe at length.

PERSONALS PICKED UP AND NOTES OF THE ELECTRIC LIGHT CONVENTION.

R. W. Pope, representing Day's kerite, is an active participant in convention work.

The REVIEW headquarters are receiving pleasant calls from all. The register of names is already quite large.

The carbon boys are here, looking fresh and rosy. When asked about the "busted" combination they only smile.

The Western Electric Company is represented by the genial F. W. Harrington, who is on his native heath at Boston.

Col. M. W. Goodyear, of E. S. Greeley & Co., New York, is expected over Thursday. Until then we shall do the best we can.

W. F. Swift, an old newspaper man, now the active secretary of the parent Brush Company, is here, greeting many friends.

Dr. Otto A. Moses, fresh from a visit with Parisian friends, is a popular attendant, and one of the best speakers at the convention.

H. D. Stanley, of Bridgeport Brass Company, is present in full strength and beauty. He is an important member of the wire gauge committee.

Reuben T. Robinson, of the Riverside Mills, and a very practical electrician, never misses a convention, and is here by a large majority.

A number of the wide-awake members of the parent Thomson-Houston Company are on the ground, greeting the delegates with true Boston heartiness.

Mr. E. R. Weeks, of Kansas City, a thoughtful, earnest member, has never missed a meeting of the association, and is one of the main men in its proceedings.

Marmaduke M. M. Slattery, of the Sun Company, is always to be found when wanted. He is an entertaining talker, and an ingenious and capable electrician.

Mr. Cyrus O. Baker, jr., the strawberry blonde from Newark, N. J., is conspicuous at all times, and is at all times welcome. His extensive platinum works are kept busy filling orders from electrical people.

Mr. Fred. A. Gilbert seemed to be everywhere, and in this Mr. Frank Ridlon, another diminutive Bostonian, was a successful coworker. Much of the labor of this convention devolved on these two gentlemen, and the universal verdict is that they have acquitted themselves with highest honors.

President Morrison has a good staff of electricians with him, and the many excellent points of his Baxter motor are being constantly shown and exhibited He has the motors at work in a number of different situations, and is making a display of great value to the electric motor as a whole and to the Baxter in particular.

The beautiful invitations to the annual clambake of Mr. Eugene Phillips, president of the American Electrical Works at Providence, have been received by a large number of the attendants, and it is safe to say that the bake on Friday will be the great success and enjoyable affair that Mr. Phillips and his co-worker, Mr. Sawyer, have made so popular.

Non-magnetic time-pieces are attracting much attention from the electrical workers. Mr. A. C. Smith, secretary of the Geneva Non-Magnetic Watch Company, of New York, is here with some of his new and handsome watches, in which the compensating balance and spring are made of non-magnetic metal, under C. A. Paillard's invention, and which are being largely purchased by all whose business calls them among electrical machines and appliances.

Messrs. Willard L. Candee and Geo. T. Manson, of the Okonite Company, New York, have hospitable quarters. A unique and ingenious rubber inkstand holder, on which appears a number of cable ends and mention of the Okonite cables, was presented by these gentlemen to the delegates and visitors. The demand for them is great. This company has recently completed its new factories for manufacturing submarine cables—a branch of the work in which they are doing a large business,

The Action of a Tornado, and the Cause of Cyclones.

When the conditions of atmospheric instability have given birth to a tornado, the fact is announced to the observer by a sudden gathering of dark, swift-whirling clouds, from which depends a writhing, serpent-like body, formed of condensed vapor. This writhing column extends rapidly downward, until it touches the earth. When it attains the surface, it becomes audible from the violent rending actions which it creates upon that surface. As soon as the whirl is created, it begins to move away, generally toward the northeast—for the evident reason that the upper cold layer of air against which it originates, has, in the northern hemisphere, a movement in that direction.

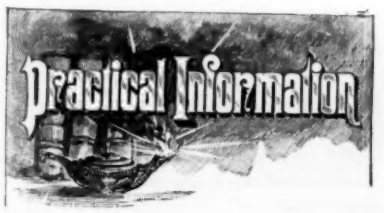
In its path over the surface, the circling movement of the writhing air, and the sucking action of the partial vacuum in the central portion of the shaft, combine to bring about an extreme devastation. On the outside of the whirl, the air, which rushes in a circling path toward the vortex, overturns all movable objects, and in the center these objects, if they are not too heavy, are sucked up as by a great air-pump. Thus the roofs of houses, bodies of men and animals, may be lifted to great elevations, until they are tossed by the tumultuous movements beyond the limits of the ascending currents, and fall back upon the earth. Where the center of the whirlwind passes over a building, the sudden decrease in the pressure of the outer air often causes the atmosphere which is contained within the walls suddenly to press against the sides of the structure, so that these sides are quickly driven outward, as if by a charge of gunpowder.

It is not unlikely that the diminution of pressure brought about by the passage of the interior of the whirl over a building may be about as much as is indicated by the fall of four inches in the barometer. This is equivalent to a change in the pressure amounting to about three hundred pounds to the square foot. This force operates to burst out the walls of a building. It is not improbable that the diminution of pressure may be much greater than this, but even the amount named is sufficient to account for the bursting out of the frail-walled structures which these devastating movements encounter in the western parts of the United States.

THE CAUSE OF CYCLONES.

In cyclones we find the largest manifestation of that energy by which the superheated lower air whirls upward from the earth through openings which it has rent in the higher cooler layers. In its fundamental cause the cyclone is essentially like both the lesser classes of whirls, the dust whirls and tornadoes, but the field of its work is vastly greater, though the energy which it exercises at any one point is less. The conditions which lead to the formation of a cyclone are as follows: In those heated portions of land and sea where the circumstances permit the air to remain for a long time undisturbed, it becomes very warm and charged with moisture; the hotter it becomes the more moisture it contains, and the less it permits the heat radiating from the surface to pass through its texture; at the same time the upper air, deprived of its usual share of radiant heat, becomes abnormally cold; finally, as in the dust-whirls and tornadoes, the lower air breaks through the upper and rushes toward the sky. Although at its beginning a cyclonic storm is probably of no greater size and of much less ascending force than a tornado, there are several reasons which make its history different from that of the smaller whirls. In the first place, the field of heated air which causes the cyclone is far more extensive than that which produces the tornado, though at the same time the difference of temperature between the upper and lower air may be less. The greater bulk of the lower stratum of hot and moist air permits the cyclone to grow larger, but the less ascensional force of the lower air makes it rather less violent in its movements

As soon as the ascending current brings a portion of the heated air from the surface into the higher level it expands, and the force, originally in the form of heat, which kept it in the state of vapor, serves to increase the ascending column just as much as would the direct application of heat sufficient to vaporize the water. Thus we have two sources of force to impel the air in the cyclone upward. Both these forces appear in the tornado, but there the original heat of the lower air is the principal cause of the motion.—From "The Instability of the Atmosphere," by N. S. Shaler, in *Scribner's Magazine* for August.



Disks for the armatures of small dynamos and motors are comparatively costly if stamped to order from sheet metal. Wrought-iron washers about ⅛in. thick of any size up to 3in. may be bought at heavy hardware stores and will be found to answer the purpose exceedingly well.

* * M. Tamine, of Brussels, has devised an accumulator of the Planté type, in which the liquid consists of a saturated solution of sulphate of zinc, to which is added 50 per cent. of sulphuric acid, 5 per cent. of sulphate of ammonia and 5 per cent. of sulphate of mercury. In making up the cell it is stated that the ingredients should be poured in in the reverse order to that here enumerated. The E.M.F. of the cell is given as 2.3 volts. The addition of sulphates of mercury and ammonia is said to prevent the formation of sulphate of lead on open circuit. The solution appears to be practically identical with that employed in M. Mezerolle's cell.

* * A syndicate has been formed at Brussels with a view to the acquisition of the whole of the Belgian patents (of any practical importance) relating to secondary batteries. It is believed that arrangements will be concluded with most of the present holders on the basis of an average royalty of two centimes per kilogramme of plates manufactured. The principal object in view is to unite all the valuable features at present distributed amongst numerous patents so as to obtain the best possible form of cell free from all patent troubles and trials. This is a sensible idea, and we hope to hear that the negotiations have been carried to a successful issue in time for the International Exhibition which is to take place next year at Brussels.

* * Mr. Ed. P. Thompson has found that the blackening of the glass of incandescent lamps is chiefly due to the carbon particles which are driven off on first closing the circuit when the filament obtains a static charge. In order to avoid this Mr. Thompson has made lamps in which the filament surrounds a loop or stem of copper wire, which passes through the stem of the lamp and is connected to earth; the wire being also provided with several points which project towards the filament. The result is that when the static charge is received the carbon molecules tend to be projected upon the wire, and the blackening of the glass is prevented. Mr. Thompson's theoretical explanation of the effect is certainly sufficiently plausible to merit consideration, but it appears to us that if this view were correct it would follow that incandescent lamps supplied with alternating currents should blacken much more rapidly than with continuous currents, and their life should be much shorter. We have not learnt that such a result has ever been observed, and it would almost appear that this objection is fatal to the static charge theory.

Electrical "Chestnuts."

To the Editor of Electrical Review:

To settle a bet, please inform us if the following articles, recently published by an electrical journal without intimation as to dates are, or are not chestnuts. I have no file of the the REVIEW to refer to: "Underground Wires," by F. P. Barrett, and "Electric Welding," by Prof. Elihu Thomson. Yours, D. A. A.

Bloomington, Ill., Aug. 3, 1887.

ANSWERS.—"Underground Wires" was read by Prof. Barrett, of Chicago, before the National Association of Fire Engineers at Providence, R. I., August 24, 1886, and was published in full in this paper August 28th, four days after.

"Welding," by Thomson, was published in this country and in Europe in 1886 It appeared in the REVIEW December 18th of that year.

There is nothing very new about electrical literature a year old. But there are scientific journals which go back to the first volumes of Chambers' Encylopædia to find padding, and call it news,

Telephonic News

*** The electric storms of the past two weeks have played sad havoc among the telephone exchanges.

*** A Frenchman has invented a telephone which costs but 62½ cents. But just wait until this company fixes the rent, before you waste any congratulations.—*Exchange.*

*** The Southern New England Telephone Company is pushing ahead rapidly with its reconstruction. A recent order for 500 new magneto-bells was placed with the Western Electric Company, through Mr. F. W. Harrington.

*** There are as many telephone subscribers in New York and Brooklyn as in all Italy with its 28,000,000 of people; as many in Boston as in Holland with its 4 000,000; more in Chicago than in all the dominion of the Czar.

*** The Bell Telephone Company has commenced suit in the U. S. Court, at Findlay, Ohio, against such citizens of Findlay as are now using the Cushman telephone, an exchange of which has just been put in operation there.

*** Mr. J. K. Butler, formerly of Stamford, Conn., has gone to Philadelphia, and will be connected in an official capacity with the American Telephone and Telegraph Company. Mr. Butler is an experienced and reliable telephone man.

*** The telephone of Dr. Cornelius Herz, Paris, has been adopted by the Government, and will be placed in thousands of parishes all over the republic of France, the main or central office to be in the Government buildings at Paris. This is a big thing for the inventor.

*** A child was recently watching a young lady busily talking into a telephone transmitter. Suddenly the child said, "Who are you talking to?" The lady answered, "I'm talking to a man." The child replied, "Well, he must be an awful little man to live in such a small house as that."

*** A singular fire occurred in New York a few days ago in the following manner: By the crossing of two wires sparks were produced which set fire to an old or partly decayed telegraph pole in John street, opposite the Western Union building. There were about 150 wires hung on the pole. An alarm of fire was sounded, and soon engines arrived and the pole was saved. The flames were near the top, and it was with some difficulty that water could be raised to such a height; but at last the effort was successful and the flames were overcome, amid the shouts from the 2,000 or 3,000 persons who had assembled on Broadway.

*** An electric trumpet is said to have been devised by a French electrician. It consists of a short brass tube mounted on wood and containing an electro-magnet whose ends face a vibrating plate, on which is fixed a small piece of soft iron. Against the plate armature rests a regulating screw with platinum point, which serves for automatic interruption by vibration of the armature. With two Leblanche elements a musical sound is obtained, which may be varied in pitch, intensity, and timbre by means of the screw. This instrument may be usefully employed in signaling on ships, railways, tramways, etc.; it may also serve as a receiver for signals of the Morse type.

*** A New Haven reporter, after visiting the telephone exchange, published the following free advice to telephone subscribers:

Don't get mad. It won't do any good.

Remember that you are not the only person on the wire.

Don't ring your telephone more than once in the hope of annoying the operator into answering you. It won't do any good.

Don't ring the bell when the lightning plug is in. It may be a nuisement, but it does not have any effect in the central office.

Remember that in other cities they often wait ten minutes before getting an answer.

Speak as plainly as you can, and make your ears as receptive as possible.

Keep cool.

Don't blame the service always. Once in a while you may have a good grievance. Ventilate the complaint at the proper place.

Statement of the Missouri and Kansas Telephone Company.

This company has declared a dividend of one and one-half per cent. payable August 1. President Mulvane and Secretary Crandall have sent out the following to the stockholders:

I present you a comparative statement showing the earnings and expenses of the Missouri and Kansas Telephone Company for the first and second quarters of 1887.

We have expended in reconstruction and repairs during the last three months, $12,871.26, as against $9,654.95 during the previons quarter.

There have been added 328 subscribers, at an expense of $15,805.43, which includes switchboard capacity for 200 more subscribers at Kansas City.

We have built 93 miles of extra territorial and toll lines, at a cost of $10,799.46.

There are now on file applications for 100 sets of exchange instruments.

Respectfully,
J. L. MULVANE, Pres't.

EARNINGS AND EXPENSES OF MISSOURI AND KANSAS TELEPHONE COMPANY FOR THE THREE MONTHS ENDING MARCH 31, 1887.

Gross earnings	$79,699.10
Gross expenses	52,496.99
Net earnings	27,202 11
Dividend No. 9, 1½ per cent	18,154.50
Balance to surplus	9,047.61
Cost of construction for the quarter,	5,580.20
Subscribers added during the quarter,	295

EARNINGS AND EXPENSES OF MISSOURI AND KANSAS TELEPHONE COMPANY FOR THE THREE MONTHS ENDING JUNE 30, 1887.

Gross earnings	$86,001.77
Gross expenses	55,080.60
Net earnings	30,921.17
Amount required for dividend No. 10, 1½ per cent., payable August 1	18,157.50
Balance to surplus	12,763.67
Cost of construction for the quarter,	26,604.89
Subscribers added during the quarter,	328

C. D. CRANDALL,
Sec'y and Treas.
Kansas City, Mo., July 20, 1887.

Photographing Electricity.

The Royal Meteorological Society is desirous of obtaining photographs of flashes of lightning, as it is believed that a great deal of research on this subject can only be persued by means of the camera. The council of the society intimate that they would esteem it a great favor if assistance were afforded in this matter, either by sending copies of any photographs of lightning that may have been already taken, or by endeavoring to procure them, or to interest others in the work. It may, perhaps, be well to mention that the photography of lightning does not present any particular difficulties. If a rapid plate and an ordinary rapid doublet with full aperture be left uncovered at night during a thunder storm for a short time flashes of lightning will, after development, be found in some cases to have impressed themselves upon the plate. The only difficulty is the uncertainty whether any particular flash will happen to have been in the field of view. As the thunder storm season is now here, many photographers may be found willing to take up this interesting branch of their art.

A Telephone Story.

Father O'Halloran had a telephone put into the parsonage, in connection with the church, the parochial school, etc. Patrick McFee, his reverence's handy man, was instructed in the use of the instrument, and it was only the next day when Pat, dusting out the church, heard the chatter of the telephone bell. Taking down the receiver, he was pleased to hear Father O'Halloran's familiar voice, asking him something of other about his work. Pat, in essaying to answer, remembered that his reverence was a long way off, and Pat consequently hollered into the transmitter at the top of his voice. "I don't understand you, Patrick," said the telephone. Pat tried again, with no better success. On his third trial he came near splitting the telephone; but again came Father O'Halloran's voice, "I can't hear what you are saying, Patrick." Pat had lost his patience, and as he stood gathering breath for a fourth blast, he couldn't refrain from soliloquizing in a low tone, 'Ah! may the devil fly way wid the ould fool!" But Pat dropped the telephone, like a hot potato, and fell to his knees in dismay, when he heard Father O'Halloran's voice once again, "Now I hear you perfectly, Patrick."

The Telephone in China.

Wharton Barker sat cool and happy in his office yesterday, says the Philadelphia *Times*, greeting everybody who entered with a smile. The cause of Mr. Barker's glee is the fact that the Chinese Government had signed a decree giving a syndicate of Philadelphia capitalists, of whom Mr. Barker is foremost, the absolute control for fifty years of the telephone business throughout the empire.

The negotiations were made by Mr. Barker with the Chinese Minister at Washington and by Count Mitkiewiez, a Russian nobleman, with Li Hung Chang, the Chinese viceroy. Government envoys empowered to close the contract will accompany Count Mitkiewiez to America.

It is said that the half dozen intimate friends whom Mr. Barker took into confidence advanced $10,000 each to start the project. The Chinese Government agrees to take one-half the stock of the new company, and the Americans believe they have so good a thing that there will be no trouble in raising funds for the other half. A party of seven men, with wire and other material for a line of one hundred and sixty miles in length, is now at work in the empire, and Mr. Barker says the work will be pushed and the lines extended as rapidly as possible. A large European and American population, not only in the coast cities, but in the interior, is making such inroads upon Chinese modes of business that the telephone has become a necessity. The company will be at liberty to use whatever kind of instrument it deems best, and as there are no Chinese patents the company will make its own instruments.

An Electric Exploder for Mines.

A new electric exploder for use in mines has lately been introduced in England by G. E. Smith; it is described as follows:

This little dynamo weighs 5½ pounds, and packs in a case about 7 inch cube. The baseboard measures 6 inches by 5 inches. The hand-wheel is 6 in. diameter. The machine is wound with wire on what is known as the shunt principle; the field magnets to a resistance of 4½ ohms or thereabouts. The armature is of the H class, double wound with wire. It is capable of giving a current of about eight volts and two amperes, if turned quickly, and would then light a four candle-power incandescent lamp, or give a light equal to two at least of the best and brightest safety lamps. It explodes fuses in a remarkable manner, a couple of turns of the hand-wheel being, as a rule, sufficient for Abel's fuse.

There is a peculiarity in the connection, which renders the machine useful for other purposes by a slight alteration in the position of one of the brushes or collectors. Unlike other forms of electric exploders, it has no permanent magnets to require magnetizing; and, unlike the friction exploder, it is unaffected by damp atmosphere. The price is also below that of the other machine (price about 40s.) It is much lighter in weight to carry about the mine. The incandescent lamp could be attached to examine the roof or anything near when the shot had been fired, being, as all know, a perfectly safe light even in gas. It will also fire the platinum fuse, which the other exploders will not, if made for Abel's fuse. As this particular machine was not made for exploding fuses only, it has the keys and safety plug separate, but of course one or both of these arrangements could be attached to the baseboard where necessary.

Electricity Applied to Line Fishing.

The true sportsman will certainly scout the idea that electricity can possibly lay claim to any legitimate share in the placid delights of the disciples of rod and line. It may possibly, however, be necessary to remind him that fly-fishing is not the only method of pursuing the business. Float-fishing, although undeniably the very laziest "sport" under the sun, is still followed, and such being the case, there can be little doubt that its devotees will welcome any development which still further diminishes the necessity for any exertion in the pursuit of their ignoble art. The only room for improvement in this direction appears to lie in the possibility of rendering it unnecessary for the fisherman to keep his eye upon the float. For this end an arrangement has been devised whereby a pull upon the line closes the circuit of a tiny battery carried in the base of the rod, and this is made either to sound an alarm or to gently tickle the hand of the fisherman as he grasps the butt. The sport has thus been brought to a state of the highest perfection, for nothing now hinders him from going comfortably to sleep.

The Ethics of Telegraphy.

We who belong to the fraternity know how accurate an index to character is the method of manipulating a wire.

An experienced telegraphist can determine with the greatest exactness the precise temperament of the clerk to whom he works. It is an interesting study to watch and analyze the various exhibitions of temperament in connection with the working of the wires in a large office.

There sits a highly strung nervous young lady, who, on receiving some kind of provocation from the "man" at the other end (the young ladies always fancy it is a man at the other end), gives the key a petulant thump, pouts her pretty lips, and indulges in a feminine swear at the "horrid thing" who is inflicting so much agony upon her. But this is no jocular matter at times, for it is really painful to see one of these delicate creatures writhing under the torture of working to an incompetent or insolent clerk. Nothing strains the nerves more than this mental agitation, and if the clerk be naturally of a nervous disposition, and gives way on every little provocation to such displays of temper, the nervous system gets thoroughly worn out, and unless a check is put upon this tendency, mental disease is sure to set in. Although I write this in a somewhat dogmatic strain, I know full well how very difficult it is for a sensitive clerk to restrain his or her irritability. I will even admit that I myself am not superior to this weakness on certain occasions, but I wish to emphasize, all the same, the vital need there is for all such clerks putting, as a matter of self-preservation, a temperate restraint upon themselves.

Why should we waste our vital force in that useless and hurtful manner? The ordinary demands upon the nervous resources of telegraphists are sufficiently exhausting, without adding to them by gratuitous outbursts of temper. Many a time have I envied some muscular recruit from a rural district working away, under all sorts of trying conditions, with a serenity that nothing could disturb. Some of these stolid individuals are either so tough in fiber, or so obtuse in mental capacity, that when they are "bullied" on the wire they evince not the slightest sign of discomposure. What an enviable gift it is to be able to sit out a volley of "cheek" from an amiable clerk at the other end, and to have the fortitude to ask the irate grinder when he has finished what he was talking about, or to "repeat," please. That is sometimes done in a fit of abstraction by some verdant grinder from green lanes, but it is often practiced with conspicuous success by "cute" operators who like to enjoy a quiet chuckle over the fiery ebullitions of the "fellow" at the other end. As a psychological study, it is most interesting to observe the respective mental attitudes of operators in performing their work. That fellow who is always in a state of effervescence, and who can hardly sit quietly on his seat for five minutes at a stretch, is the individual who does his work on the mechanical principle—that is, he never allows his mind to get so deeply absorbed in his work as to make it laborious or exhausting to him. That is the clerk who, on crossing the threshold of the office for home, forgets that he is a telegraphist until his return to duty on the morrow, when he resumes his work with the same mechanical serenity. Although this idiosyncrasy is but a reflex of a particular temperament, it does not necessarily imply a want of interest by its possessor in his work, for this class of clerk may, and invariably does, his work in as careful a manner as a different type of telegraphist whom he shall now endeavor to portray. The antithesis of temperament to the foregoing example is that of the clerk who loses his personality in his work so thoroughly, and merges his whole mental faculties in his duties so completely, that after a hard day's work he feels languid and exhausted, and even after he has left the office he carries about with him an official atmosphere, which clings to him throughout all his leisure hours. This is the clerk who always looks jaded and dispirited, and who, at times, conveys the impression to the sym-

pathetic observer that he dwells in a world which is peopled with nameless shadows, and with a vague sense of unrest. Pity and sympathize with such a clerk, be it a man or a woman, for he or she is a victim to that peace-destroying malady—nervous exhaustion. These are the clerks who are predisposed to nervous ailments, and when they have the misfortune to work to inferior clerks, and are subjected to a continual worry, the ordeal is one that, repeated pretty often, drives them to a premature grave. This is not an artificial or overdrawn picture, as all thoughtful observers of the present state of things will admit.

The large infusion of raw talent into the service since the advent of the sixpenny rate, has made working on busy wires, to which many of these incipient operators are often put, a very trying ordeal to an "old stager." It is all very well to talk of exercising patience with a learner, but it is nothing short of cruelty to an experienced clerk to submit to the incompetent, and invariably insolent, method of working affected by some of these ambitious youths, who go to busy wires with the express intention of "making it hot" for the fellow at the other end. It is often necessary to take steps to have the wings of these bantam operators clipped by getting them removed from a busy wire to one where their capacities for mischief will have less scope. Much depends upon the thoughtful and kindly supervision of the superintendent to keep such evils in check, and we are glad to be able to say that we know of such men who take a pleasure in ministering to the comfort of the clerks under their charge.

Taking our fraternity as a whole, it bears certain distinctive features which clearly mark and divide it from other clerical professions. A strong taint of Bohemianism still clings to the modern telegraphist, but it is easy to adduce palliative reasons for it as a general characteristic. Time was when the bibulous propensity was so strong amongst the male clerks, that it was no uncommon thing for thirsty grinders to send out a boy for their liquor and consume it within the office precincts. I will not say that that obnoxious habit has been totally abandoned, but it is a very rare occurrence to see it indulged nowadays. It is in fact, a very unsafe proceeding in these days of vigilant supervision. The introduction of female clerks into the department has, I am glad to say, raised the tone of the staff above what it used to be in the old days, when Bohemianism was so rampant. Candid, sensible men will freely admit the truth of that assertion, just as it is a truism that may be applied to many other professions where the gentler sex have been admitted. This is the natural order of things, and were it otherwise, it would be a circumstance of ominous significance. Generally speaking, the work is better performed at a wire where there is a female, as well as a male telegraphist, and in the case of a single current wire where there is a lady telegraphist at one end. It needs no profound analysis to explain or justify such a perfectly natural state of things as that. In any of our big offices, where female labor is largely employed, I think it will be generally admitted, despite the carping criticisms of a few old curmudgeons, that the atmosphere is all the brighter and healthier, and that the work is done more cheerfully for the presence of the young ladies. It is to be regretted, not on their account but on ours, that their official sojourn amongst us is generally so brief, for we have hardly got to know them thoroughly when some Romeo from the outer world comes and snatches them away. A pretty girl's clerkship in a telegraph office may be roughly but not inaccurately estimated at about six years. A few stay a little longer, but these are the hardened sinners who keep three or four "fellows" dangling at their apron-strings, just as an Indian keeps his scalps at his belt, to show to the onlookers some tangible proof of her or his prowess.

I have often thought, looking back over the vista of my long service, that telegraphy exercises a strange spell over the most of us. We enter the service with enthusiasm, find it pregnant with untold possibilities, pursue the work for the first few years with unabated ardor, and then comes a period of reflection, setting in just when we think we have learned all that is possible. This is the sign of the novelty and fascination of the work passing off, and when we have made that discovery we think the only way to renew the glamour is to make a change by entering the service of the cable companies. If that impulse be not soon acted upon the next stage of the process sets in, and we drop into the indifferent, languid state—a state from which, generally speaking, there is no awakening.—*Telegraphist.*

The Electric Bolt—What it Can Do When it Really Tries.

Six young men of Scranton had a terrible experience and remarkable escape from death during the prevalence of a thunder storm at Gravel Pond, a small sheet of water in the woods, six miles from Scranton, on Sunday night. They were camped there, occupying a small tent, which was pitched in a grove of large trees on the margin of the pond. One immense oak tree stood within ten feet of the tent. No tree was more than thirty feet away. Near the tent door was a rock that would weigh hundreds of pounds. Their experiences are thus related by the correspondent of the New York *Sun:*

"We turned in for the night at about 9.30 o'clock," says E. M. Beyea, in relating the story of the party's experience. "The ground inside the tent was covered deep with hemlock boughs to sleep on. We had a hammock swung in the tent, and Harris got into that. All the rest of us lay in a row on the hemlock boughs. Will Weston was on the outside of the row, Fred. Friend next, I next to him, with my bicycle standing between us. The storm came up a short time after we had gone to bed, and it came up rapidly.

THE THUNDER WAS TERRIFIC.

One clap followed another in quick succession, and the play of lightning was so continuous that it was impossible to tell which flash heralded the crash of thunder. The grove and the lake were illuminated with such an electric light as I never want to see again. The rain came down like a torrent. That frightful war of thunder and lightning continued without cessation for more than an hour, and then suddenly there came the most tremendous crash of any that had preceded it, and the flash of lightning came simultaneously with it. There was a great rush and roar and crackling among the trees outside. The tent was filled with a great sheet of fire. I felt a terrible burning sensation pass like a flash up my left leg and side to my shoulders, across the shoulders, and down the right side and leg to the ends of my toes. Then I knew no more until I was aroused by movements of some of my companions. Harris, the two Warner boys, and myself had been unconscious for several minutes. Harris, in the hammock, had come to first. All complained of a strange numbness. The tent was filled with a

SCORCHED AND SULPHUROUS SMELL.

It was some time after the four of us had got around and began to compare notes before we discovered that neither Will Weston nor Fred Friend was moving. We began an investigation, and discovered that they were both unconscious. We succeeded in reviving Friend in half an hour or so, but it was only after more than an hour's hard and persistent rubbing and manipulation of Weston's limbs and body that we got his blood to circulating, and brought him round. It was a long time after that before he or Friend were able to stir about much and understood what had happened. Weston was injured the worst of any. From his left shoulder, and extending diagonally across his back to his right hip, was a broad red burn. On his left arm was a red burn in shape of a cross, and a similarly shaped mark on his left leg. He had kept his shoes on when he laid down on the boughs. They had nails here and there in the soles. On the bottom of his feet, wherever there was a nail in his shoes, was a round blister. Friend's arms and legs were seared all over by the cross-shaped burns. I was scorched considerably on my legs, sides, and shoulders, but nothing like Weston and Friend. None of the rest of the party were burned by the lightning, but all were benumbed. The burns and scorches smarted and pained so that they were almost unbearable, especially Weston's and Friend's, and are still very sore and painful. The sensation that we all felt when the crash and the flash overwhelmed us was as if everything was being whirled around at a tremendous rate, first one way and then the other, and then both ways at once. Burt Warner said, also, that he felt as if he were being driven into the ground by the crash and then thrown out again to the surface.

THE STORM HAD SUBSIDED

by the time we had in a measure recovered ourselves, and we set ourselves to looking about to see what other effect the terrible electrical disturbance had had. It was then that we first discovered that the big rock which lay outside the tent when we bunked in had been forced from its position and rolled inside, and that it had stopped within not more than three inches of where Will Weston's head had lain when the crash came. Going outside, we found that the grove in which we were camped had been disastrously dealt with by the lightning. No less than seven immense trees had been struck and their branches and splintered trunks scattered about in all directions. The great oak tree in front of the tent had been split in two, and a piece of it, forty feet long and half a foot or more thick, had in falling just grazed our tent and lay almost across the door. A hole two or three feet deep and as much in diameter had been plowed in the ground near by, but where the dirt and stones that had come out of it had gone to could not be discovered. I forgot to say that when the tent was filled with the flash of lightning, the electrical fluid played about the steel spokes of my bicycle, radiating with them and whirling about in changing colors, for all the world like some magnificent piece of fireworks. The hemlock boughs in which we lay, and which had been fresh and green when we lay down, were burned yellow by the lightning, yet not a stitch of our clothing nor the tent was in the least affected. It is hardly necessary to say that we did not tarry on the scene of that night's experience any longer than it took us to strike our tent and pull for home."

More Telegraph Wire Wanted.

A dispatch from Dallas, Texas, says: As an illustration of the magnitude of telegraphic construction in the country, the railroads of Texas alone need now, and will construct as soon as the materials and men can be had, 5,000 miles of additional wire.

To handle with ease and dispatch the present business of the roads and meet the requirements of the commerce of the State, at least that much more additional wire is required. The Missouri Pacific alone needs 1,200 miles of new wire, but it cannot be had. The Texas and Pacific needs double wires in many places where it now has but one, and three wires where two have heretofore been sufficient. The same is true of the Santa Fe, the Houston and Texas Central, the Southern Pacific and all other roads in the State, all of which are stretching new wire as fast as they can get it.

Sherlock's Tell-Tale Telegraph for Steamships.

This is an automatic tell-tale, placed in the engine room of ships, and arranged so that should the engineer in charge misread the indication given on the ordinary telegraph dial, or should he move over the reversing link contrary to orders, an electric alarm would be set ringing, and would continue to ring until the mistake was rectified. This is done by means of a contact plate capable of moving in a vertical direction, and controlled by the movement of the reversing lever. This plate has a hole in its center, into which projects an insulated point fixed on a plate whose circular movement is worked from the finger on the dial in the engine room. When an order is signaled by the officer in charge, and is recorded on the dial in the engine room, the contact point is moved round, and if the order is fulfilled the contact plate is necessarily moved in the same direction as the point; but should the reversing lever be moved in the opposite direction, then the plate also moves in the opposite direction, thus closing an electrical circuit through the point and ringing a bell.

.... Mr. Geo. M. Meyers, General Manager of the Pacific Mutual Telegraph Company, Kansas City, Mo., and Mr. Paul W. Bossart, Superintendent of the Inter-State Electric Company, of Kansas City, are in the East, arranging the Electrical Accumulator Company to handle their storage batteries in certain portions of the West.

TELEGRAPHIC

.... And now comes the report that an effort is to be made to purchase the B. & O. Telegraph Company, and sell it to the Government for postal service. That would be nice.

.... Prof. Thomson says that when the means of utilizing the power of creating quick heating by electricity is better understood, it will be used in every workshop for welding, forging and other purposes.

.... Fiberite is a new insulating material made from wood pulp by the Fiberite Manufacturing Company, of Skowhegan, Me. It is now being used for storage cells and by various electrical concerns, and is said to be giving satisfaction.

.... A manufacturer at Roubaix has indented a useful application of electricity to looms. He adopts an indicator which strikes when a thread breaks, and thus saves the weaver from the close attention to the quick moving threads, which is so injurious to the sight.

..... The Colombian Government has granted to the Central and South American Telegraph Company authority to establish and operate telegraph lines across the Isthmus of Panama, and to extend its cables into Colon and along the Atlantic coast of South America.

....During a thunder storm at Mayflower, Ark., on July 12, a fine horse, a colt, and three young steers, were struck by lightning. The animals were lying down and were six or eight yards apart. The bolt seemed to jump from one to another, doing fatal work in each case.

.... During a thunder storm lightning struck the railroad track leading into the fire clay mine at Farrandsville. Mine Boss William Ross and James Mull were prostrated by the shock, while all the men at work in the mine were badly stunned. The men say the mine was literally filled with electricity.

.... Jay Gould, it is said, promised some of the office boys in the main office of the Western Union Telegraph Company, that he would give each of them a suit of clothes when the company handled 100,000 messages in one day at its main office. On June 27, the company handled 105,000 messages, and Gould paid for five suits of clothes.

.... Albany Division No. 13, Order of Railroad Telegraphers of the United States, meet in the Y. M. C. A. rooms, Gardiner building, Broadway, Saratoga, August 20, at 8 P. M., and extend an invitation to all railroad telegraph operators to be present. It is a special meeting, the object being to increase the order's membership and further its interests, and C. E. Burke, of Saratoga Springs, is to preside. The organization, which was only recently effected, has grown rapidly. Of the 30,162 railroad operators in the country, 13,000 are said to belong to the order.

..... Superintendent John Curran, of the Fire Alarm and Police Telegraph, San Francisco, filed his twenty-second annual report with the Board of Supervisors yesterday. After stating the work performed and improvements made, he says the expenses amounted to $16,309.12. He recommends that the existing plant of private gongs, which are placed in the residences of the "call" members of the fire department, be substituted by newly constructed circuits, to be maintained by the city government, and incorporated into the fire department, thereby guaranteeing to the department that reliability which is afforded over the regular wires. If the recommendation is adopted the services of an additional lineman will be required in the construction and inspection of the auxiliary lines. Thanks are tendered to the Mayor, the Supervisors, Board of Fire Underwriters and the officers of the fire department for the satisfactory manner in which they have sustained the reputation of this department.

ELECTRIC LIGHT NEWS

—— The new Edison Company, in Columbus, Ohio, is putting all its wires under ground. The Callender solid system has been adopted.

—— The Northampton Electric Light Company is making important additions to its equipment, and has now a circuit of 115 arc lights and 200 incandescent.

—— The Austin Water, Light and Power Company, Austin, Tex., has been formally organized. It will increase the electric light plant it has already established.

—— The Grand Rapids Edison Company has given the Callender Company the contract for laying all its feeders underground. There will be about fifteen miles of large cable used.

—— The electric lighting station at Salt Lake City, Utah, will be hereafter managed by the Salt Lake City Gas Light Company, the latter having purchased a controlling interest in the former.

—— The electric belting of Chas. A. Schieren & Co., New York, has been adopted by the Rock Island County Brush Electric Light Company, Rock Island, Ill., and Glens Falls Gas Light Company, Glens Falls, N. Y.

—— Mr. Julian Denison, an employe of the electric light company at New Haven, is said to have invented an automatic carbon feeder, which will contain seventeen carbons, doing away with the trimmer's work to a large extent.

—— An electric light company has been organized at Webster, Mass., with a capital stock of $10,000. N. T. Hulburt is president and Waldo Johnson treasurer. Besides the street lighting, a large business from merchants is secured.

—— The U. S. Electric Lighting Company, Washington, are putting in a large Edison central station. All the feeders are to be underground. The cables, some of which will have nearly an area of one inch of copper, are being made by the Callender Company.

—— The stockholders of the American Electric Light Company, 32 Nassau street, New York, have decided to dissolve the company. Since 1882 it has done no active business. It united with the Eastern company to form the Consolidated, which afterwards leased its rights to the Sawyer-Man Company. The American's assets consist principally of Consolidated stock. The assets will meet the obligations.

—— The electric light is making great progress in Germany. The German Edison Company, in its report, recently issued, states that up to the end of 1886 the company had put up no fewer than 260 installations, including 70,000 incandescent and 1,000 arc lights. The company sold during 1886 90,000 incandescent lamps, as against 60,000 in the preceding year, and its outlook for business at the present time is remarkably good.

—— Dr. Otto, of Germany, inventor and patentee of the Otto gas engine, has commenced suits in the United States Court, Southern District of New York, for injunction and damages against parties making and using the Korting gas engine. Among those sued are Adolph Wittemann, Geo. F. Sturken, John C. Seaman and Melville C. Thwing, all of New York city.

—— The Westinghouse Electric Company of Pittsburgh has orders ahead to keep its full force of 775 men working steadily until November 1. Among the electric plants under construction are those for Colorado Springs, Easton, Md., Sheffield, Ala., Beaver Dam, Wis., Denver, Portland, Me., Charleston, W. Va., Galveston, and Austin, Tex., and a number of others. Work has been commenced on the new eight-story addition to the plant on Garrison alley.

—— The British Admiralty has invited tenders for the supply of 34 sets of dynamos and engines. Five of the dynamos are to be of 400 ampere capacity, seven of 300 amperes, and the remaining 22 of 200 amperes.

—— An experimental installation of 500 candle power arc lamps has been erected in the streets of Liege, Belgium, the current from each being provided by a small combined dynamo and motor placed in the pedestal of the lamp-post.

—— The Newark Electric Light and Power Company, of Newark, O., has been incorporated, with a capital stock of $20,000. Messrs. H. H. Pratt, W. F. Walworth, J. O. Moss, Thos. Wood and A. N. Prout are named as incorporators.

—— The West Point Water, Light and Power Company, West Point, Va., has been organized by P. H. Adams, T. B. Henley, T. W. Sharp, C. H. Richardson, B W. Hefferom, A. C. Nickle and E. Wilkinson. Capital, $25,000.

—— The American Illuminating Company, of Augusta, Ga., which was incorporated in December last, is meeting with fine success, and is in a marked degree a brilliant example of what can be accomplished in the electric lighting field by giving to it the same attention which every other successful business receives. Starting out with an instalment of 85 lights in January, it was not long before an increase was found to be absolutely necessary, and another 25-light machine and lamps was added. The steadiness and quality of the light produced created such a demand for the American light that a further increase has become imperative. The directors have just ordered from the American Electric Manufacturing Company an additional 100 lights, and have contracted for an additional 200 horse power engine, and will then have one of the largest and finest electric light plants in the South.

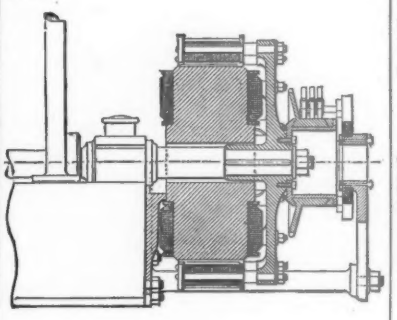


FIG. 3.

SIEMENS & HALSKE DYNAMO.

—— An isolated plant has recently been installed at the country house of Mr. James A. Wright, near Philadelphia. It consists of 100 light Edison machine, an eight horse power vertical engine, a vertical fifteen horse power tubular boiler, and 110 cells of the Electrical Accumulator Company's 15 A type, connected up two in series. The batteries are charged four hours weekly. Standard Edison 106 volt sixteen candle power lamps are used. The plant has now been in operation about a month.

—— Electricity has been a powerful factor in opening the eyes of gas companies that it was really necessary to make a change in their business methods. The gas industry has wonderfully developed within the past ten years, and especially so since the electric light dared to show the yellow of the coal gas illuminant. The companies have encouraged and welcomed regenerative gas lamps, and stimulating the sale of gas by day. In Berlin, Paris, Brussels and Vienna a similar result has been brought about. A great number of gas works throughout Germany are now selling gas for motive power purposes at a cheaper rate than for lighting, by which policy the sale of gas has been increased, notwithstanding the competition from electric lighting. Some of the gas companies also encourage the adoption of gas engines and gas heating appliances by arranging periodical exhibitions of such apparatus.—*The Gas Engineer.*

The New Siemens and Halske Dynamo Machine.

The aim of the manufacturers of this machine is to save as much as possible the loss of the lines of force, and diminish the useless iron parts. The engineers of Mr. Siemen have come to the same conclusion as those of Ganz & Co., as will be seen by comparing the machines.

As can be seen by Figs. 1 and 2, the dynamo is a machine of four poles and a ring with stationary inside inductors. These are cast, and form a part of one of the pedestals. The outside ring, of large dimensions, is made of iron sheets, bolted together to a star mounted on the shaft, turning loose.

There are four brushes, though it is possible to reduce them to two, through special connections. It has been preferable to use ordinary connections, at least for the four-pole machines.

The velocity varies from 350 to 450 revolutions.

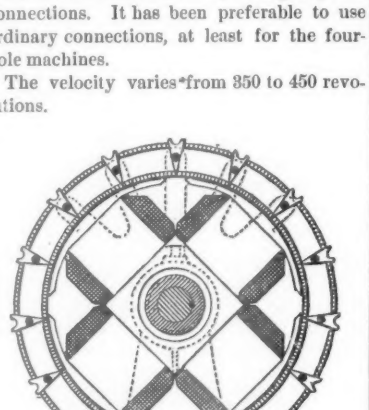


FIG. 1.

As to mechanical advantages, the most important ones are the practical divisions of the armature. It is possible to make these of parts entirely independent, and change them in case of accident. The whole machine is easily taken apart.

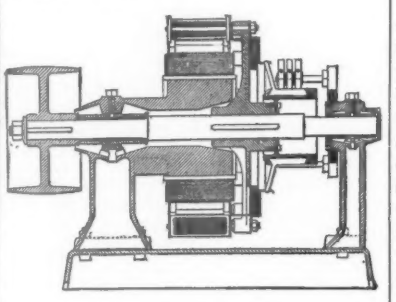


FIG. 2.

They claim that this machine, with 350 revolutions, produced 16,000 watts, and 25,000 with 480 revolutions per minute. This last figure is somewhat exaggerated—20,000 watts is nearer the correct figure, which will make 44.4 kil per electric horse power.

—— A very complete system of electric lighting has been fitted up throughout the large new mills just erected at Bury, England, by the Peel Spinning Company. The installation, which comprises some 500 lamps of the Weston type with wavy filaments, has been carried out by the Maxim-Weston Company through its local agent. The necessary current is obtained from two shunt-wound Weston dynamos, one of which is driven by a separate horizontal engine of 25 indicated horse power, and the other by means of a countershaft and rope pulley from the large mill engines. Each machine supplies current for some 250 lamps, the whole number being alternated as usual; so that in case of any accident occurring to one dynamo the other is still able to sustain sufficient lamps for carrying on the ordinary mill work. The engine power is divided in the same way to attain this end.

* * Although cable roads have been in existence so long, the total length in this country in operation or in course of construction does not exceed 150 miles.

Turbine Wheel and Dynamo Coupled Direct.

The accompanying illustration represents a Girard turbine constructed with a horizontal shaft. In order to obtain moderate speed under a high head, the wheel is made very large in diameter, and the water is admitted to a small portion only of the internal circumference of the wheel by means of five guide ports. A slide worked by hand through a worm with wheel and pinion closes the guide ports in succession, and also serves as a stop valve. The wheel is 42 inches internal diameter, and the vanes or buckets are formed of steel. A wrought-iron cover, not shown in our illustration, is placed over the wheel to prevent the water splashing into the turbine house. The turbine is enclosed in a strong cast-iron case. The regulation is effected by a single guide port furnished with a gun metal slide. By means of a hand wheel and worm, gearing into a wheel connected to a screw, this slide may be moved up or down so as to increase or decrease the discharge area of the port.

—— An insulating plate which, while very thin and light, is absolutely impermeable to moisture and to air, may be made by taking two leaves of tin-foil coated with a thin layer of gutta percha solution (dissolved in benzine or carbon di-sulphide) and placing them face to face, separated by a leaf of thin paper of close texture. This suggestion is due to M. Bandsept.

* * The splendors and marvels described in the Arabian Nights tales, says the *Practical Mechanic*, are more than matched by modern works of skill and genius, and the most startling and novel triumphs of to-day have been brought about by the application of electricity to purposes of communication, illumination and power. The magician's wand of olden time is to-day replaced by the push button and the electric switch, at the mere touch of which night is turned into day, power is transmitted scores of miles, and intercourse is rendered easy between remote places.

* * John Ericsson, the man whose inventive skill gave to this country the iron-clad Monitor, the opportune appearance of which in Hampton Roads, during the rebellion, "like a cheese-box on a raft," turned the tide of a famous naval battle in favor of the United States ships, has just seen his eighty-fourth birthday. The veteran is still a vigorous worker, spending fourteen hours a day in his laboratory, and feels as strong, mentally and physically, as he did a score of years ago. He attributes his exemption from most of the ills to which humanity is heir to a regular and temperate life and common sense in choice of food. This means, in brief, that he never takes alcoholic stimulants, refrains from the use of tobacco, eats meat sparely, and indulges in much pedestrian exercise. The death of this hardy old man would be greatly deplored, and it is to be trusted that he will stick to his peculiar health-giving regimen until he has perfected his sun motor and other promising inventions upon which his active brain has been concentrated for some years past.

A satisfactory test of a surface car operated by electricity was made at the establishment of Wharton & Co., Philadelphia in the presence of a number of railway officials. The car was supplied with eighty-four storage batteries manufactured by the Electrical Accumulator Company, placed beneath the seats, which furnished electricity to a Sprague motor geared to the axle of the front wheels. The car was run about experimentally, after which it was run out on to the tracks of the Union Line and switched to the tracks of the Spruce and Pine streets line. A round trip was made, the car, when the tracks was clear for any considerable distance, attaining a speed of eight miles an hour. At times the car was completely filled, and it was considered that a thoroughly practical test was given it. All the sharp curves were rounded satisfactorily. At all times the car was under absolute control. The man in charge can, by the device at his hand, readily stop, start and back the car, as well as regulate its speed. An electric bell is sounded as a warning signal. By means of push-buttons, the conductor can signal the driver to stop or start. It is estimated that the cost of running the electric cars is from two-thirds to three-fourths the cost of horse power.

Boston Electric Light Convention.

(*Proceedings continued from page* 1.)

THE MEETING AN IMMENSE SUCCESS. LARGE ATTENDANCE. TUESDAY AND WEDNESDAY'S PROCEEDINGS.

President Morrison called the convention to order at 10:15 A. M., in the large double parlors of the Parker House, some 150 attendants being present at that hour. W. H. Harding, of Baltimore, acted as Secretary. Mr. Morrison spoke as follows, and was greatly applauded:

MR. MORRISON'S OPENING SPEECH.

Gentlemen of the National Electric Light Association: I have again to congratulate you upon the success of your organization which the large attendance to-day from all over the country evidences.

Inventive ability and irrepressible energy of the most pronounced character still further encourage us in the belief that if electrical business does not achieve a phenomenal success, it shall not be for want of intellectual activity, energy and integrity.

Great progress has been made in the last six months in electric lighting generally, but especially in the development of incandescent systems. The induction system, which permits of low tension lamps, at a great distance from the station, is a branch of lighting that has greatly increased since the last convention, and is now successfully conducted in numerous places. This system, more than any other formerly in use, is designed to find its place in the illumination of private houses. Its flexibility is very great. Its farther development is encouraging.

Lighting by storage batteries has also received a great impetus within the last three months, and while there are still some difficulties to overcome in certain branches of illumination, it is fast superseding the dangerous oil lamp on railway trains.

Dynamos have been perfected, so as to give greater efficiency per pound of metal used, and our electricians are constantly working to reduce the cost of the machines, and thereby insure a large market for the same.

The perfection of the arc lamp has increased, and the demand for the same in the last six months exceeds the output of the previous eighteen months.

Mill owners, etc., are beginning to realize the enormous advantages of the electrical illuminant, not only in the more healthful condition of the operative, but also in the greatly decreased fire risks. The underwriters throughout the country recommend the introduction of incandescent lights to their patrons, in all factories where inflammatory fabrics are made.

Abroad the introduction of electrical installations has been slow and unsatisfactory, but of late our brethren across the ocean have taken up the subject with vigor, and to-day are becomming formidable rivals in the enterprising spirit of this country in the adoption of electric energy for all uses.

The Patent Office question, perplexing and unsatisfactory as we are all aware it is, is now receiving attention through the agitation of the subject by this Association, and we intend to keep this matter before the world until legislation shall be compelled to furnish what is needful.

As suggestive of the multiplicity of uses to which electricity may be put, Lieut. Murdock submits a paper setting forth and explaining the electrical requirements for the new Government cruisers; and although this especial electrical application would necessarily be limited, it will, no doubt, be useful, and still farther evidences the desire and demand for the applications of electrical devices in every branch of industry.

The perplexing wire gauge matter will again be placed before you, and if the work of the past six months of the committee on this subject corresponds with the exhaustive and excellent report made at the last convention, we may expect something definite enough this time to decide the attitude of this Association in relation thereto.

I regret to have to announce the absence of the report of the Committee on Insulation of Wire and the proper installation and construction of plant. This committee requested the Association to provide the necessary means to enable them to carry out their investigation. But, as the Association was in no condition to render them the pecuniary aid they required, they determined not to pursue their work any farther. I believe this to be a loss to the Association, from the statements they have made of what they intended to do, if they only had the means. I can easily foresee the loss of a great deal of valuable information to ourselves and to the world at large.

I have now the honor of introducing to this Association one of the most popular mayors that the city of Boston has ever had—a gentleman who represents public interests more than the interests of any particular party or clique, and who, under the most trying circumstances, has shown his fidelity as a public representative, to such an extent as shall make his official administration one of the most memorable landmarks in the history of Boston's progress.

Gentlemen, I now have the pleasure of introducing Mayor O'Brien.

Mayor O'Brien spoke eloquently as follows, and was often interrupted with applause:

MAYOR O'BRIEN'S ADDRESS.

Mr. President and Gentlemen of the National Electric Light Association: You almost overcome me, Mr. President, by your very flattering remarks; but it gives the mayor of Boston great pleasure to welcome so many distinguished gentlemen to the city who are engaged in a very important work. I hope your visit will be a pleasant one, as also a profitable one, and if you can show us any way whereby we can light our streets and dwellings better than the work is now done, we shall be very thankful to you, Mr. President, and your Association.

I read in the papers a few weeks ago that immense fortunes were made in the electric lighting business. It must be a very attractive business, and I suppose now that I am addressing not only men engaged in electric lighting work, but millionaires of various degrees. (Laughter). Our experience in Boston does not, I am sorry to say, corroborate that fact. Electric lighting so far has been introduced by the energy, the ability and the intelligence of men who have been engaged in local lighting. I believe it is their intelligence that has scattered electric light over the country in such large proportions in every city and many of the towns and countries. So far, I believe, profits have not been very equally divided. Some few men, I have no doubt, have grown rich in the electric lighting business; but I am satisfied that every man who has started a local company, either in this city or in any other city of the country, has been more a public benefactor than one who made any pecuniary benefit from his work. I do not intend gentlemen, to advise you or say anything about the work which you are engaged in. I have no doubt your discussions will be interesting, and I hope that your visit to Boston will be a pleasant and agreeable one. I know it must be very satisfactory to many of you, coming from cities and towns where the thermometer ranges up to the hundreds, to visit so delightful a city as we have here in Boston, where you can enjoy good fresh air at about 65. (Laughter). And if you have time, it would give me pleasure to take you down our beautiful harbor and into our beautiful suburbs, and I hope you will not leave Boston before you visit each of those places.

If you can give us any advice about the electric motor, we should be very much obliged to you. We have got street car lines running in all directions, and we would like to run them by electric motors, but the experience of electric lighting men in these parts shows that experiments are very expensive, and we hope that some of you who are running electric railroad motors in other sections of the country will give us some intelligent advice on that subject. We also believe in the motor business here. Boston has neglected small industries. I believe if you establish a motor that will do the work, that you will enable us to build up a great many small industries that have been neglected in the city of Boston.

I will not detain you any longer, gentlemen but I again hope that your visit to Boston will be a pleasant one to you all.

Treasurer's report, showing a balance of $860 on hand, was read and accepted.

This was followed by report of Committee on Patent Legislation by Mr. Arthur Steuart, of Baltimore.

Mr. Ridlon offered a resolution to accept the report, and continue the committee and authorize them to take such steps as seem necessary to secure the passage of such a bill by Congress. Adopted.

Mr. De Camp submitted a draft of a new constitution and by-laws.

Mr. Duncan moved to recommit the report to the committee, as the report centralized power in President, and also because the committee had no authority to present new constitution, but only amendments.

Mr. Smith, of Pittsburgh, thought the constitution too broad, as it took in all supply companies, and suggested the words "electric light" be taken out. (Laughter).

Mr. Cooper moved that the committee be requested to report again during the sessions of the present convention; and after some remarks by President Morrison, favoring certain changes, this was carried, and Mr. Dun can added to the committee.

Report of Wire Guage Committee by Mr. A. V. Garratt followed, Mr. Garratt speaking as follows:

Mr. President and Members of the National Electric Light Association: A year ago in Detroit, a committee was appointed to consider the matter of wire gauge, which at that time was in an almost hopeless condition. After six months of constant correspondence with the largest users and makers of wire in this country and abroad, and the leading scientists in the specialty of electricity, I reported at Philadelphia that this Association do two things: First, that it vote that the British standard gauge be no longer the recognized gauge of this Association, and secondly, that the metric system be made the basis of measuring wire. Both of those motions—or they were incorporated in one motion, one report—were accepted. The honor conferred upon me in accepting my report was not less than the honor I received in being again placed at the head of the committee to elaborate this subject. The committee was considerably increased by the addition of some valuable members. During the six months we have taken the subject of measuring wire in simple diameter in the tenth of a millimeter, and have elaborated it into a mathematical table. This table is not of necessity a gauge, although the first column to the left represents a series of even numbers—integral numbers, which agree with the tenths of millimeters, which appear in the next column or column No. 2. The object of doing that is this: In sending telegraphic messages I find it is almost impossible to make a telegraph operator use a decimal point. It is almost impossible also, in hasty writing, to get the decimal point in the right place. For common purposes, in speaking of wires in ordinary business parlance, a simple number is more convenient than a number with a decimal point—for this reason, a column of figures is here placed with simply that decimal point removed. That, however, is not the gauge, if there is any gauge. The gauge, if there be one, is the simply measuring of wires in diameter in tenths of a millimeter. That appears in column 2. As we have in this country a unit which is much more familiar—the inch—it seemed wise to this committee to convert those diameters into inches for the purpose of referring to tables which are already constructed, and with which many electricians are thoroughly familiar. For that reason, table No. 2 was multiplied by a constant, which represents tenths of millimeters in the denomination of inches. It was multiplied simply by the number (illustrating). That converts the tenths of millimeters into inches, so that though unfamiliar with the metrical properties of wires, you can readily refer to those tables and see just where they are. An electrician looks upon a wire not as a wire as we ordinarily express it, but as a cylinder, and the properties of wires are based upon the properties of cylinders. There are three properties of wires which enter into the work which we have to do—the tensile strength of the wire. That I shall not touch upon; it is a subject by itself, and does not directly interest us.

The third property is the conductivity, and it is necessary for us to know the ratios of conductivity to weight, to size in diameter and to length of conductor. The first thing we want to know about a cylinder to determine its physical properties is its sectional area. In this particular table, to insure almost absolute accuracy the mathematical work was done independently by two members of the committee. Mr. P. Keilholtz, of Baltimore, independently calculated tables 4 and 5 which you see here. Mr. Herbert H. Eustis calculated the same tables. They were both submitted to me; I compared them and found some differences. Where differences occurred I independently made two calculations upon different days, and if those two calculations agreed I submitted them to the other gentlemen, and the alteration was made in their calculation. Virtually, then, these columns 4 and 5 have been independently calculated by three persons. The likelihood of error has been reduced to a minimum by not calculating it by ordinary arithmetic, but by calculating it in logarithms, and the logarithm was used that is used in fine astronomical calculations—the seventh place logarithm compiled by Vega. I will say that carries the accuracy so far that even in calculations as to the solar system very slight errors are found. In that calculation comes in the property of the pi-ratio. This section area was calculated by these two gentlemen from different formulæ. Mr. Eustis calculated it from the square of the radius of this cylinder multiplied by this ratio. Mr. Keilholtz calculated it by this formula (illustrating)—the square of the diameter multiplied by 5 and divided by 4—two entirely independent calculations. Probably the tables here of area in square millimeters and square inches is about as correct as it is possible to make a table of figures. The calculation into the square inch, of course, was an independent calculation bringing in the ratio which we already have between the inch and the square millimeter.

Before I go on to the other details I will say here why we put this question of sectional area so conspicuously on this table and so near the beginning. The properties of conductivity of wire are directly proportional to the sectional area. I wish to refer one moment back. This figure here, 314,159, the pi-ratio, is one which has never been written out. There is another number after this 9 and another after that. A distinguished French mathematician has carried that to 250 places of decimals, and there are others beyond that.

These tables of area are based upon that. The conductivities of wire are proportional to sectional area. They are, however, proportional to another property of cylinders which is entirely independent of the pi-ratio and which is extremely simple in practical use. The conductivities of wires are directly proportional to the squares of their diameters. You will find away over here in column No. 16, squares of diameters. Wires have to be used by a great many men who are too hurried in life to familiarize themselves with mathematics and with electrical formulæ and who want to get quickly at what wires may be expected to do. From this simple table, No. 16, by simple arithemetic you can arrive at almost any physical or electrical property of the cylinder or of the wire which is a cylinder. For instance, if I have a small wire or if I have twenty small wires and I wanted to have a large wire of the same conductivity I would simply have to take that square of diameter multiplied by thirty and look in the table, and find the nearest corresponding

numbers in this column No. 16, and I would have the wire which would give the same conductivity. In problems involved in the work which linemen are obliged to do who do not care to go into these matters at all, they have in such a table necessary data for determining nearly everything which they would be required to know.

I do not think I will go into determining constants, which is a long mathematical work, and I think it will be understood how these various other properties were determined. I will say, however, that they were figured independently by two members of the committee. The units were taken from Mattison's last determination—the British Association unit—multiplied by the constant which converts that resistance into the legal ohm. Hence that resistance and also the physical properties against the resistance, such as feet per ohm and pounds per ohm corresponding to the legal ohm.

Many gentlemen will take exception to the fact that this is calculated at zero Centigrade. This convention, if it sends out this circular, has got to commit itself towards the scientific world as having done a thing which no trade body in the United States has heretofore done. It is a scientific matter. It will be studied. These calculations will be gone over by scientists and mathematicians. Zero Centigrade is now recognized the world over as the unit of temperature. There is no probability in the immediate future of its being changed at all. I have corresponded with leading professional electricians in this country, and without a single exception they replied to me—by all means determine your gauge on zero. Every electrician is familiar with the simple constant, which is .0021; by multiplying the zero Centigrade, which is 32 Fahrenheit, by the number of degrees which it will differ from what we want if you want to convert to 75 Fahrenheit, and multiply it by the constant, you will get the resistance of it in 75 Fahrenheit, and you can do it at any other temperature at which you see fit to do it. But the zero Centigrade is that on which all scientific work is based when the question of temperature is involved.

The question of making these determinations of resistance, etc., on commercial copper or on pure copper, the committee found it utterly impossible to determine what commercial copper was; hence, this table has been calculated upon the basis of chemically pure copper. If any manufacturers adopt and use this it will be very easy for them to attend a constant at the bottom of their table, which you can multiply into any one of these properties and convert your weight, your resistance, etc., directly into the degree of purity which they claim to put out commercially, and in this Association we have got to have a thing which can be used as a standard all over the country, and for that reason chemically pure copper was taken. Mr. Garratt then explained the tables at some length.

In closing the report, Mr. Garratt remarked that the government had been consulted regarding a new wire gauge and would give the one proposed full consideration, and if satisfactory it would be adopted as the government standard. The electrotypes of the tables of mathematical properties of the metric wire gauge, which are being distributed, were in process of preparation and wire manufacturers could obtain the whole or portion to print in their catalogues.

Dr. Moses said that while a member of the committee, owing to sickness and absence he had been unable to take active part in the work on the new gauge, and that all the credit and praise belonged to the other members for their laborious work. There was no necessity to advocate the metric system, even Germany had been forced to use it.

Mr. Mason said that as he understood Mr. Garratt, the convention accepted the metric gauge at the previous meeting, and now nothing was to be done but to decide if the committee had done its clerical work well.

At the suggestion of the President, the minutes of the Philadelphia meeting were read, from which it was apparent that the report of the committee had been accepted, not adopted.

Mr. Lynch said if Mr. Garratt would add to the table a column of figures giving the safe carrying capacity in amperes of the different sizes, the table would be much more useful.

Mr. Garratt replied that it was only necessary to multiply the numbers in the column of areas by a constant to be found in many books.

Mr. Lynch suggested that such constants be placed in the table.

Mr. Phelps said he should hesitate to promulgate another wire gauge—that this table was not a wire gauge, but an aid.

The President suggested that the report be made a special order for some other day, and on motion of Mr. Mason it was assigned to first hour, Thursday.

The report of the Committee on Insulation and Construction of Plants was called for.

Mr. Robinson said as a member of the committee he had a few days ago received a rough draft of the report which he was unable to endorse. The rest of the committee had resigned, and he wished to do the same. Resignation accepted.

The President said that at the 9th June meeting of the executive committee a request came from the Committee on Insulation and Construction, asking for a fund of $1,000 for instruments and for repairs of apparatus used in the University of Pennsylvania, and an assistant at $3.00 per day. As the funds are applied to the running expenses of the Association, no such sum was on hand, and the request coulp not be granted. Nothing was heard from the committee till this report was received a few days ago, which will appear in our next.

The report was, on motion of Mr. Leggett, of Detroit, laid on the table.

The notice of the invitation of the Boston Electric Club to the Convention to banquet at Point of Pines, and visit Thomson-Houston Works, was then read. The invitation was accepted, and the session adjourned to 2:30 p.m.

Afternoon Session.

Mr. Slattery said: In absence of the chairman of the committee he would endeavor to make a few remarks on this subject (the induction), which is fraught with many complexities. With his usual grace of diction, he alluded to the early remarks of Dr. Otto Moses, stating that many of his statements, which were at the time looked upon as enthusiastic, have since been found to contain much sober truth. First the dynamo. The early difficulties were many. For one, the danger of the current jumping across the insulation of the coils at a moment when by accident there was an open circuit. One of the strong points is the very high property of self-regulation, the regulation being due to the use of the induction coils. The accidents which have been heretofore made have been due to mechanical faults, and have been met by better mechanical construction. The great source of short-circuiting seemed to be the poor insulating property of the wire used in the induction coils. Another apparent defect lay in the enormously high current developed in the secondary circuit, if a short circuit there occurred. This trouble was met by introducing proper fusible strips in the secondary, so arranged that, in event of their being melted, an arc could not be formed. The speaker alluded to the ease with which large coils could be placed where they can act as central station dynamos, these large coils being fed with high tension currents, carried on comparatively small conductors. The question of the danger of touching these high-tension alternating currents was then alluded to, and Mr. Slattery referred to a case where a person had placed his hands across the terminals of an alternating machine, developing at the time something over a thousand volts. He expressed the opinion that in the near future this kind of apparatus would cause no uneasiness among those who handled it.

Mr. Duncan, of Pittsburgh, said: There is no question about the efficient working of the alternating system. There are some difficulties which are rapidly being done away with. There is no difficulty in covering the area required. His experience was that to day the induction coil could be relied on to do its work as well as other electrical apparatus. In regard to the dynamo he alluded to machines which had run three months, every day and night but Sunday, when a short rest had been given for proper cleaning, etc.

Mr. Smith, of Pittsburgh, said: Had some experience with the alternating system, and he had found that its enormous flexibility enabled you to do almost anything you pleased. He aluded to the ease with which buildings now lighted by the direct system could be altered over into the alternating plan. He also referred to the question of touching the wires, and stated that he had taken 1,000 volts alternating. He described a man who had taken 1,000 volts for some four minutes, his hand having closed on a key socket and the man lying on a wet earth floor.

Dr. Otto Moses said: The alternating machines at Pittsburgh which he spoke of at the last convention, had then been running but two months. He had just spent two days at Pittsburgh and was glad to say that the system was actually doing what he hoped they would do. He mentioned a 2,500 machine doing its work well, and he emphasized the fact that these large machines seemed to be of exactly the same proportions as the smaller one. If you can double and quadruple the output of a machine without changing its shape in the least, where is this going to stop? He believes that eventually machines of 10,000 lamps would be made.

Mr. Slattery called for information from Westinghouse representatives.

Mr. Smith, of Pittsburgh, replied that in Philadelphia they are using lead-covered cables in wooden box filled with pitch. In some places they used iron pipes through which the lead covered cables are drawn, and the pipe then filled with pitch.

In closing the discussion Mr. Slattery said that he felt that he was sure that all gentlemen must feel that we had been much repaid by the valuable information which had been stated by the gentlemen present.

Mr. E. R. Weeks read an interesting paper on "Electrical Education," and then the convention adjourned to 10 A. M. Wednesday.

Wednesday's Proceedings.

The special committee reported in favor of Pittsburgh as the next place of holding meeting on February next.

S. A. Duncan was chosen chairman of executive committee, with following gentlemen as members: Lynch, Gilbert, Leggett, Smith and Dr. Moses.

A very interesting paper on "Electric Light on the new Cruisers," by Lieut. J. B. Murdock, U. S. N., was read and discussed, and will appear in full in next issue.

President Morrison tendered his resignation for the third time, but convention declined to accept.

The Treasurer, Charles A. Cooper, tendered his resignation, which was accepted.

Consumers reported unfavorably on proposition to form a United Carbon Company.

An interesting address by Dr. Waldo was then listened to on silicon bronze wire for electrical purposes, which will appear in full later. Convention then adjourned for the day to visit the Thomson-Houston Electric Light Works, and take a boat excursion.

Among the attendants up to Wednesday morning are: Messrs. J. F. Morrison, Wm. Baxter, Pierre Keilholtz, T. McCoubray, R. W. Evans, W. H. Harding. T. M Greene, Baltimore; Stephen Holbrooke, H. B. Sharps, N. H. Edgerton, W. B. Buchanan, Harry Hall, J. A. Pentz, Wm. Hillman, Geo. Porter, S. B. Richards, Philadelphia; A. C. Smith, Eugene T. Lynch, Jr., Dr. Otto A. Moses, Geo. T. Manson, C. W. Price, New York; J. DuShane, South Bend, Ind.; C. W. Stewart, St. Joseph; E. R. Weeks, Kansas City; J. H. Shay, J. H. Reid, G Atkinson, J. B. Crouse, W. H. Laurence, F. E Pettingill, Cleveland; W. H. McL. Harding, New York; James English, New Haven; S. J. Hart, New Orleans; W. I. Wark, New York; W. R. Kimball, F. W. Harrington, Boston; A. J. De Camp, Philadelphia; J. H. Thomas, Chicago; T. P. Keck, Savannah; C. A. Brayton, Geo. W. Short, E. B. Guthrie, Cleveland; Addison Conkling, New York; A. V. Garratt, F. M. Gil y, Boston; C. L. Wright, Geo. W. Mansfield, J. J. Miller, Wm. Henderson, Cleveland; C. H. Barney, New York; A. W. Butterworth, C. W. Ranson, R. F. Ross, Frank Ridlon, P. H. Alexander, Hugh O'Brien, Fred. A. Gilbert, A. H. Chapman, F. A. Boynton, Boston; J. K. Wead, Hartford; S. A. Duncan, J. A. Henderson, Pittsburgh; A. F. Mason, H. M. French, M. M. M. Slattery, A. F. Upton, E. I. Garfield, Boston; S. O. Richardson, Boston; E. F Gennert, W. F. Cullen, Norman McCarty, F. E. Kinsweller, New York; Wm. Brophy, Boston; Wm. S. Frear, J. C. Weber, Buffalo; C. O. Baker, jr., Newark; W. F. Swift, Cleveland; H. N. Curtis, J. W. Godfrey, New York; Geo. W. Parker, D R. Russell; St. Louis; T. C. Frenyear, Boston: William G. Clark, Chelsea: J. A. Hendrix, S. E. Barton, Boston; W. H. Silsby, Newburg, Vt.; Gardiner C. Sims, Providence; Geo. W. Phelps, jr., R. W. Pope, New York; James G. Haynes, A. G. McCleur, Boston; D. A. Dangler; W. C. Hayes, W. H. Boulton, Cleveland; C. A. Gates, Massilon; Tho. P. Bailey, C. S. Rusling, Kansas City; J. F. Patten, Duluth, Minn.: A E. Bliss, Malden; Leonard Waldo, New Haven; R. H. Whittier, Providence; A. H. Brown, Chicago; H. H Eustis, H. R. Clark, Boston; M N. Packard, Baltimore; G. S. Mumford, Rochester; Jesse M. Smith, Detroit; Geo. H. Roe, San Francisco; T. Carpenter Smith, Pittsburgh; P. A. Randall, Fort Wayne; P. C. Ackerman, New York; E. T. Wightman, Danbury; C. D. Smith, Cleveland; H. L. Lufkin, New York; Chas. Cooper, Brooklyn; Arthur Steuart, Baltimore; H. D. Stanley, Bridgeport; Wm. Leggett, Detroit.

Exhibits of Electrical Apparatus at the Convention and Personal Mention.

The exhibit of the Edgerton Motor Company includes machines from one-twelfth to one horse power. A one-half horse power is shown operating a novel form of pump of a capacity of 200 gallons raises 28 feet per hour. The shaft of the motor makes 160 revolutions per minute. The pump is of the piston double acting type. The piston is attached to a double cut screw, and the rotary motion of the armature shaft is transformed into a reciprocating motion. Near by a No. 2 one-quarter horse power machine drives a flexible shaft, on the end of which is a circular brush. Sitting quietly in a comfortable chair, a visitor has his boots nicely blacked by a rotary brush while he meditates over the downfall of the historic bootblack. A one-half horse power drives a coffee mill, and a one-quarter horse power a large ventilating fan. The distinctive feature of these motors is the slow speed at which they are run to develop the rated power, the smallest, one-twelfth horse power for sewing machine, dental and polishing work, making only 400 to 450 revolutions per minute. These motors are all on series circuits of the Boston Electric Company.

The Cleveland motors are the only ones in the market having a single spool field magnet. The armature is of the Gramme type. A two horse power on arc circuit is belted on to a one-half horse power 110 volt motor, run as a dynamo supplying current for incandescent lamps. A one horse power also on the arc circuit drives a 42-inch Blackman fan; and five horse power on same circuit is belted to a three horse power 100 volt motor, operated as a generator. The current from this drives a one horse power motor and 20 incandescent lamps, lighting the parlors where the Cleveland Company has its interesting exhibit.

The Baxter motor exhibit surpasses anything of the kind ever before seen. The rooms are continually crowded. The enterprise of this company in making this magnificent exhibit will be of inestimable ad-

vantage to the motor business in general, and the Baxter in particular. A full account will appear in our next.

The C. & C. Motor Co. is represented by Mr. H. L. Lufkin. Several of their neat and popular fan motors are exhibited, and are objects of much attention.

Mr. Geo. H. Roe, with the enterprise of a true electric light man, is present from San Francisco. Everybody is glad to see him.

S. A. Barton, the very energetic manager of the Thomson-Houston Company, has deserted his Chicago office for a few days, and is taking an active part in making the visit of the electric light people agreeable.

W. F. Swift, Secretary of the Brush Electric Company, of Cleveland, is here greeting scores of friends. He has completely recovered from his recent severe illness, which compelled a southern trip, but which did not prevent his making a number of excellent contracts for new plants in the south.

The Schæffer Electric Company has their headquarters lighted up in fine style with their incandescent light.

The Thomson-Houston Company, through the Boston Electric Club, arranged an excursion down the harbor, a visit to their great works, and a banquet at Point of Pines, during Wednesday afternoon and evening, which promises to be a most delightful affair. The convention has adjourned over from Wednesday noon to Thursday morning to enjoy the event.

A new globe-holder, invented by Mr. Geo. F. Malcolm, of 160 Webster street, East Boston, is on exhibition, and is pronounced a practical and valuable thing by all electric light men. The three clasps are lined with rubber, and one is movable and fastened with half a turn of the thumb-screw. The holder can be made very cheaply of stamped metal, and it is estimated will save from 50 to 75 per cent. of the breakage in arc light globes.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUG. 2, 1887.

367,359 Galvanic battery; Horatio J. Brewer New York, N. Y.

367,402 Electric Pyrotechnics; John H. Irwin, Morton, Pa.

367,422 Electrical ore detector; Lemuel Mellett, Milford, Mass.

367,451 Galvanic battery; James Serson, Boston, Mass., assignor, by direct and mesne assignments, to the Uncle Sam Electric Light and Battery Company, Portland, Me.

367,469 System of electric distribution: Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

367,470 Regulator for dynamo-electric machines and motors; 367,481, Coupling compound dynamo-electric machines; Elihu Thomson, Lynn, Mass.

367,475 Roof for suspended electric conductors; Chas. J. Van Depoele, Chicago, Ill.

367,541 Electric ore indicator; Lemuel Mellett and Jerome Prince, Milford, assignors to said Lemuel Mellett and George Reed, Fitchburg, Mass.

367,548 Electric conductor: Thos. S. Reed, Bridgeport, Conn, assigned to the Bridgeport Brass Com, pany, same place.

367,568 Electric arc lamp; Merle J. Wightman and Hermann Lemp, Hartford, Conn., assignors to the Schuyler Electric Manufacturing Company, of Connecticut.

367,598 Electric railway signal; Edwd. M. Chase, Boston, Mass.

367,630 Electric distribution by secondary batteries; William Hockhausen, New York, N. Y.

367,650 Electrical type-writer; James F. McLaughlin, Philadelphia, Pa.

367,651 Electric motor; Alexander W. Weston St. Louis, Mo.

J. J. DICKEY, Pres. L. H. KORTY, Treas.
MIDLAND ELECTRIC CO.,
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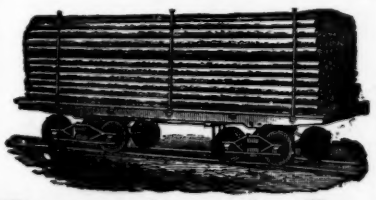
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Wm. H. Purdey, Comm. of Public Works, Chicago.
John Mab, Chief Engin'r of Board of Trade, Chic.
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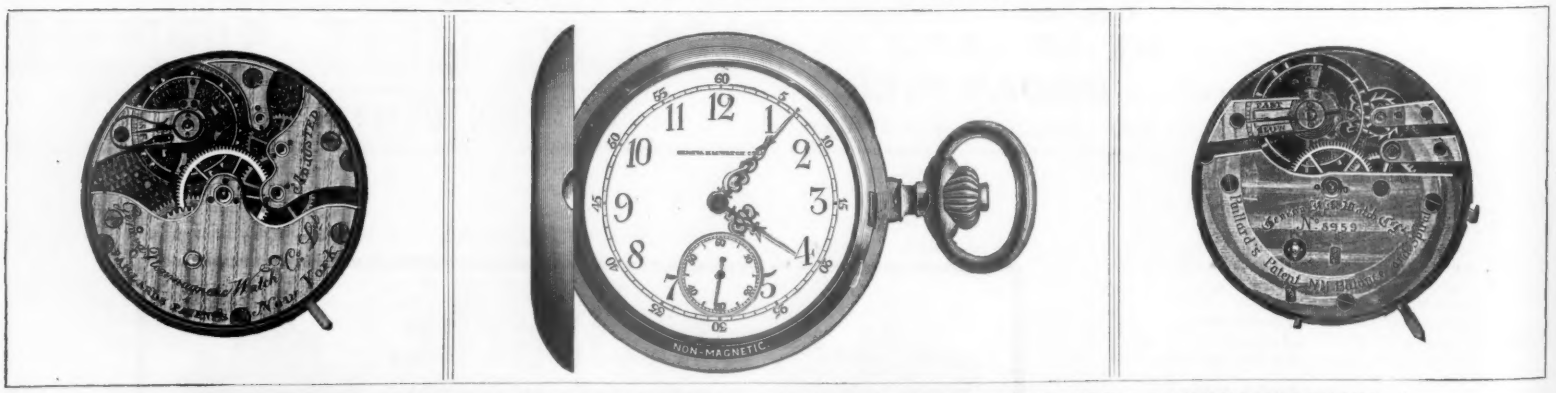

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